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Preparation of Fresh TOMATOES for MARKET



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The tomato is one of the most important of our vegetable crops. The only vegetable crop that exceeds it in farm value is the potato. During the 5-year period 1949-53, the annual farm value of the tomato crop in the United States averaged nearly \$210,000,000. Production for the fresh market averaged nearly 34,000,000 bushels annually during this period.

Many factors enter into the profitable production and marketing of a tomato crop. Satisfactory climatic conditions, soils, and cultural practices are prerequisite to the production of good quality fruit. The selection of suitable varieties, and proper methods of harvesting, grading, packaging for shipment to market, and preparation for retail sale are all important. This bulletin discusses these latter factors and describes practices that are successfully used in an effort to assist growers, shippers, and others engaged in preparing high-quality tomatoes for market.

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Preparation of Fresh Tomatoes for Market

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Areas of production

Fresh tomatoes are produced in each State in this country, but commercial production is confined to about 30 States. Approximately 122,000 growers produce tomatoes on a commercial scale and about one-half of this number are producers of tomatoes for the fresh market. The remainder grow tomatoes for canning and for manufacturing into tomato products. Ten States produce more than 80 percent of the tomatoes grown for the fresh market (fig. 1). Three of these States—California, Florida, and Texas—account for approximately 58 percent of the total.

The bulk of the carlot movement of fresh tomatoes also originates in California, Florida, and Texas. In 1953 a total of 37,022 carlots

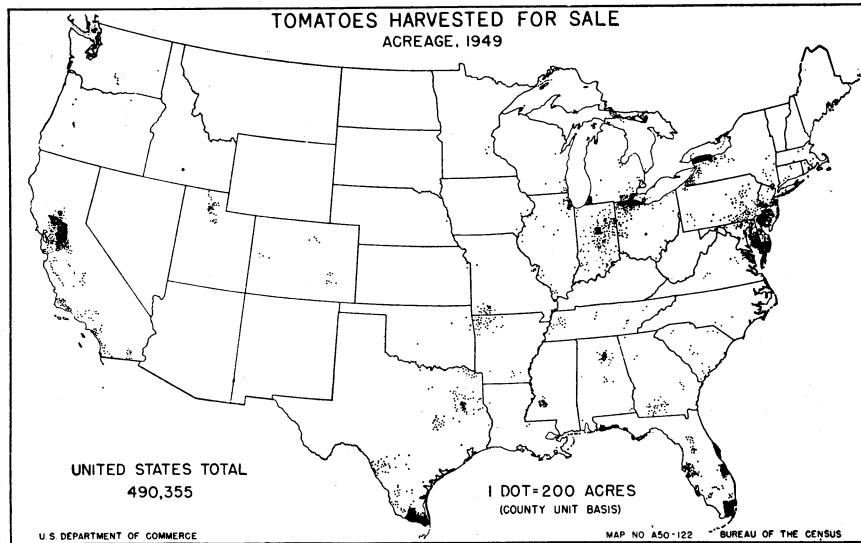


FIGURE 1.—More than 80 percent of the tomatoes for fresh market are grown in 10 States: California, Florida, Texas, New York, New Jersey, Michigan, Ohio, Georgia, Virginia, and Maryland.

¹ Acknowledgment is made of the assistance rendered by field representatives of the Agricultural Marketing Service and State marketing officials, who supplied specific information relating to various producing areas for use in this publication.

of fresh tomatoes, including truck shipments from California and Florida reduced to carlot equivalents, was shipped. Approximately 95 percent of these shipments were from the 3 leading States.

The transportation of fresh tomatoes by truck has become increasingly important in recent years. In the 3-year period 1951-53, 62 percent of the fresh tomatoes from California and 58 percent of those from Florida were shipped by truck. These are the only States from which complete reports of truck shipments are available. However, it is estimated that between one-half and two-thirds of Texas shipments move by truck. As the distance to market decreases, the proportion of tomatoes shipped by truck increases. For example, in the 5-year period 1949-53, New York produced a yearly average of 1,890,000 bushels of tomatoes for the fresh market, but an average of only 38 cars, or approximately 14,440 bushels, was shipped by rail. An average of 1,702,000 bushels was grown annually in New Jersey and no rail shipments were reported. As the figures indicate, long-distance truck shipment has become an important factor in the transportation of tomatoes to market. It is not uncommon for tomatoes to be shipped by truck from California to New York City and other eastern markets.

Recent unload reports for Chicago, New York City, Philadelphia, and other large northern cities show that many truck shipments originate in Florida and other southern producing States. Likewise, during the late summer months, when local supplies are not sufficient to meet demand, some tomatoes are moved by truck from northern producing areas to Atlanta, Jacksonville, and other cities in the South. During such periods truck shipments from California to Florida markets are not uncommon.

In recent years, some large tomato repackers in northern markets have turned again to rail transportation in order to better control temperatures in transit and to take advantage of low cost storage on track at destination.

Fortunately, the varying climates in the United States enable consumers to enjoy fresh tomatoes every month of the year.

Florida is the principal source of supply in the United States for fresh market tomatoes during the late fall, the winter, and the spring months. Texas also produces some tomatoes for the late fall market, but the bulk of its crop is marketed during May and June in competition with other late spring and early summer producing States. Considerable quantities of tomatoes from Cuba and Mexico also are imported during the winter and spring months. In addition, during this period, supplies are supplemented to some extent by production in greenhouses, principally in the East North Central, Middle Atlantic, and southern New England States. The principal areas of production in Florida are located in Saint Lucie, Dade, Collier, Manatee, Hillsborough, Okeechobee, Hendry, Indian River, Palm Beach, Marion, Broward, and Hardee Counties. Important shipping points include Fort Pierce, Vero Beach, Princeton, Homestead, and Florida City on the east coast, Palmetto and North Ruskin on the west coast, and Immokalee and Okeechobee in the interior.

During May and June Florida and Texas supply most of the fresh tomatoes; some supplies come from California, Georgia, Louisiana, South Carolina, and Mississippi. The lower Rio Grande Valley is the principal tomato-producing section in Texas. Heavy loading points in this area are: Edinburg, McAllen, Mercedes, Pharr, and Weslaco, in

Hidalgo County; Brownsville, Harlingen, La Feria, and San Benito, in Cameron County; and Raymondville, in Willacy County. More recently Laredo, in Webb County, and Eagle Pass, in Maverick County, have become quite important shipping centers. Other important producing areas in Texas include the Yoakum district, in Lavaca and De Witt Counties, and the east Texas district, in which Anderson, Bowie, Cherokee, Henderson, Panola, Shelby, Smith, and Van Zandt are the principal producing counties.

In July, shipments come largely from the early summer producing States and include California, Virginia, Maryland, Delaware, Arkansas, Tennessee, Missouri, North Carolina, Ohio, and Illinois. Some shipments also come from Texas.

Tomato shipments from California usually begin in May from the Imperial Valley and continue from other sections until December. Therefore, parts of the State are classed as early spring, early summer, and early fall. Contra Costa and San Joaquin Counties are the areas of heaviest production in the State, principal loading points being at Brentwood, Carbona, Tracy, and Stockton. Next in order of importance are Stanislaus, Merced, Santa Barbara, Monterey, San Diego, Ventura, Imperial, and Kern Counties. In Stanislaus County the principal acreage is on the west side of the San Joaquin Valley, and the chief loading points are Westley, Patterson, and Newman. This area has increased in importance during the last 4 or 5 years. In the Santa Barbara area the production has moved to Goleta, Carpinteria, and Buellton. In the San Diego area the principal shipping point is Oceanside. Saticoy is the chief loading point in Ventura County, Watsonville Junction in Monterey County, and Brawley and El Centro in Imperial County.

The Eastern Shore is the most important producing section in both Maryland and Virginia, although there is scattered production elsewhere in these States. Tomato production in Tennessee is largely confined to the vicinity of Gibson in Gibson County. Most North Carolina shipments originate in Bertie, Carteret, Scotland, and Washington Counties.

The Marietta district in southeastern Ohio furnishes a considerable supply of fresh tomatoes during late June and early July. There is also some production in the vicinity of Cincinnati. Tomatoes are grown in Union and Monroe Counties in southern Illinois and mostly loaded at the towns of Waterloo, Anna, and Cobden.

In Missouri, tomato production is centered in Jefferson County near St. Louis and in the southwestern part of the State. Production in Arkansas is largely confined to several counties in the extreme northwestern part of the State, although there is scattered production elsewhere.

Liberal supplies of fresh tomatoes usually are furnished from mid-summer to frost by scattered production in a large number of late summer producing States, which include New York, New Jersey, Michigan, Pennsylvania, Washington, Massachusetts, Indiana, Connecticut, Colorado, Oregon, the northern parts of Illinois and Ohio, Kentucky, Utah, and Rhode Island. Rail shipments from most of these States are negligible as most of this production moves to market by truck.

During the last several years there has been considerable change in the relative importance of several of the tomato-producing States, although there has been comparatively little change in the standing of

the 11 most important States. Production in Florida has shown a decided increase in recent years. Texas production has declined from the peak years of 1945 and 1946, particularly in the last 3 years during which adverse weather conditions have materially curtailed the yield. Tennessee production also has decreased steadily during the same period. This decrease has been attributed to the lack of an adequate marketing system which would provide the grower with an incentive to produce high-quality tomatoes. Other contributing factors are the loss of farm labor to industry and the high price of cotton which has attracted former growers of tomatoes to produce cotton. Bad weather and disease are responsible for the marked decline in Mississippi production. However, growers in this State are again showing interest in tomatoes and plantings are increasing.

Staking and pruning as related to market quality

Two general systems of handling the plants are practiced in the various tomato-producing sections of the country. In one, the plant is allowed to develop naturally, spreading out and falling upon the ground as it develops. This is the usual practice throughout most of the producing sections in California, Florida, New Jersey, New York, Utah, Colorado, Washington, Oklahoma, Arkansas, Kentucky, Michigan, Indiana, Alabama, South Carolina, and in practically all producing areas in Texas except the Yoakum district. In the other system, the plant is allowed to develop one, two, or three stems, the number depending on the grower's estimate of the soil fertility. The stems are loosely tied to a stake driven beside each plant. As the plant grows, additional tyings are made and all side branches are cut or pinched out as they appear at the base of the plant or in the axils of the leaves.

Staking is still the prevailing practice in most of the tomato-producing areas of Tennessee, Louisiana, and in southeastern and southwestern Ohio. Some growers in the Merced area of California, the Palmetto and Manatee district of Florida, the Yoakum district in Texas, parts of Pennsylvania, Alabama, and southern Illinois also stake all or a part of their plants.

Growers of greenhouse tomatoes usually follow the single-stem system of pruning and training tomato plants, although some growers train the vines to two or three stems.² Any shoots arising from the leaf axils are removed to throw all of the energy of the plant to the main stem and to keep the vegetative parts of the plants within manageable bounds. The plants are supported either by heavy twine running from the base of the plant to an overhead attachment or by a stake driven by the side of each plant. Soft twine is used to tie the plants to the supporting twine or stake.

Some tomatoes on the first-formed or lowest clusters are often rough, ridged, or ill-shaped and are unsuitable for slicing purposes because of the large proportion of the fruit wasted in preparing it for use. Likewise, tomatoes produced on the top clusters are often not satisfactory from the market standpoint, because of small size and lack of firmness. Tomatoes in the top clusters are often sunburned, or they show sub-normal color when ripe because of the depletion of plant foliage and increasing temperatures to which the fruits are exposed. Rough or

² Farmers' Bulletin 1431, Greenhouse Tomatoes.

ill-shaped specimens from bottom clusters and thin-walled, unattractive tomatoes from top clusters are of inferior quality from the standpoint of appearance and shipping quality and should be sorted out from normal-shaped, firm, and meaty fruit before being packed for distant shipment.

Commercial varieties

The choice of varieties is an important factor in successful tomato production and marketing. In the old established tomato-growing sections varieties that are well adapted to the respective sections have been demonstrated through research and practical experience. Therefore, except for small experimental plantings of possibly superior sorts new to the section, growers should confine production to those varieties which are adapted to their section and possess the most desirable market qualities. Those varieties which produce fruit that is medium in size, smooth, and well shaped will prove the most satisfactory from the market standpoint. Tomatoes larger than $3\frac{1}{4}$ inches in diameter are often badly ridged over the shoulders or are otherwise misshapen and will seldom command as high a price as those that range from $2\frac{1}{4}$ to $3\frac{1}{4}$ inches in diameter.

It is important that varieties should not be mixed, especially those that have different kinds of red color when ripened. In some sections where several main-crop varieties are produced there is a tendency to disregard variety when packing tomatoes for shipment. These sections ordinarily ship their stock in the green stage, at which time difference in color is not apparent. After such a lot ripens, however, a mixture of yellow-red and purplish-red varieties in the same container is very noticeable and the unattractive appearance is likely to be reflected in the selling price. A mixture of varieties is not so objectionable if the stock is similarly shaped and develops the same kind of color when ripened.

Many varieties of tomatoes are grown in the United States but only a few are commercially important. Varieties which are popular today may soon be discarded for supposedly better varieties. Experiment stations and seedsmen are continually breeding new varieties and selecting improved strains of existing varieties. As a result some varieties which were extensively grown a few years ago are either not produced today or have been relegated to a position of minor importance.

The Rutgers variety is one of the most popular, both for fresh market and for processing, grown in the Eastern and Southern States. This tomato, developed at the New Jersey Agricultural Experiment Station by selections from a cross made in 1928 between Marglobe and J. T. D. varieties, was officially named and released to seedsmen and tomato growers for commercial production in 1934. Rutgers is first in importance in many States and is widely grown in others. Grothens Globe has displaced Rutgers in Florida and is now the most important variety in that State. An important new variety in Florida is Homestead, recently introduced by the U. S. Department of Agriculture and the Florida Agricultural Experiment Station. It is wilt resistant and has the same general market characteristics as Marglobe and Rutgers. Stokesdale and Valiant are most important in Michigan in plantings for fresh market alone. Longred and Rutgers are

planted for canning and the early fruit stripped for fresh market. Kopiah, a variety recently developed by the Truck Crops Branch Experiment Station at Crystal Springs, Miss., is competing for popularity with Rutgers in the limited Mississippi plantings. On the other hand, Rutgers remains the most important variety in Texas and in New York, Alabama, Tennessee, Kentucky, Arkansas, New Jersey, and Illinois, and is second only to Marglobe in a few other States, including Louisiana and South Carolina, and is also popular in Pennsylvania and Colorado.

The Rutgers is characterized by having large plants with thick stems and an abundance of vigorous foliage to protect fruits from sunburn and sunscald. Fruits are medium to large, similar in shape to those of Marglobe, have thick outer walls with small seed cavities, and firm, dark-red flesh when fully ripe.

Marglobe, the leading variety grown 15 years ago in most of the Southern, Eastern, and North Central States, is still produced to some extent. It is a prolific producer, is moderately resistant to fusarium wilt, is resistant to nailhead spot, and the fruit is generally well shaped, firm, and meaty and possesses excellent shipping qualities.

Some of the older important varieties still grown, particularly in northern producing States, are Stokesdale, John Baer, Pritchard, Baltimore, Bonny Best, and Break O'Day. Also some relatively new varieties grown which may become more popular in these States are Pan America and Valiant. The latter is important in Michigan and is grown to some extent in the Rio Grande Valley of Texas.

Varietal production also has undergone considerable change in the Western States during recent years. A few years ago Marglobe, Martin Stone, and Jack of Hearts were the leading shipping varieties in California. These varieties are of minor importance today and have been largely displaced by the Pearson, named in 1937 for its originator, O. H. Pearson, formerly of the Agricultural Experiment Station of the University of California. Fruit of the Pearson is of a slightly flattened globe shape, a little larger than the fruit of the Marglobe, is smooth, and has a tough skin, heavy walls, and numerous cells. It is deep red when ripe, a quality which has helped to make the variety also the leading one for processing in California. Pearson is also grown in Colorado, Utah, and the Northwestern States.

Other varieties grown to a lesser extent for market in the Western States are Stone, Earliana, John Moran, Pritchard, Baltimore, Bonny Best, Rutgers, Firesteel, Early Pack or 34, and possibly some yet unnamed strains sponsored by seedsmen in California.

Harvesting

Tomatoes grown under the best of conditions are highly perishable and should be harvested and packed as rapidly as consistent with careful handling practices. In the green stage they seem firm and will apparently stand a considerable amount of rough handling, but the damage becomes apparent in the markets after the fruit has ripened. Abrasions or bruises that are scarcely noticeable on a mature-green fruit are likely to appear as dark-brown or black unsightly spots at the market. Bruises and mechanically injured areas also provide an easy entrance for disease organisms, and every effort should be directed toward lessening the opportunity for such infection.

In many sections harvesting is done by laborers who are indifferent to these points. Even some well-informed growers and shippers often fail to give proper attention to the maintenance of a high-quality product. In their effort to handle a large acreage they overlook the fact that profits often depend more upon quality than upon quantity.

Time of picking

The proper stage at which tomatoes should be picked depends to a large extent on the distance from the markets. Three definite stages for marketing are recognized commercially—mature-green, pink, and ripe. Tomatoes reach a stage of maturity on the vine that will insure ripening several days before any pink or red develops on the surface. Fruit that is to be shipped long distances to market therefore is usually picked in the mature-green stage and shipped with or without refrigeration, depending upon the season of the year and weather conditions through which it is expected to pass.

Mature-green tomatoes or "green-wraps," as they are sometimes called, comprise the bulk of the shipments from Florida, Texas, California, South Carolina, Tennessee, Louisiana, Colorado, Utah, and other southern and western producing States. At this stage the tomato is almost fully grown and the interior ripening processes are well under way. The characteristic red color usually develops on some of the tomatoes during the transit period.

A large percentage of green-wrap stock arrives in the markets without a trace of red color, and even when held in ripening rooms for several days at a temperature of from 70° to 75° F. many tomatoes do not develop normal color. Usually the fault lies with the pickers who, in depending on size as the principal indication of maturity, pick the fruit before it is sufficiently developed. Also there is a tendency on the part of many shippers at the beginning of the season to ship green tomatoes before they are mature, hoping they will get top prices before tomatoes become more plentiful. Often the reverse is true and they fail to get repeat orders from a dissatisfied receiver who may have been put to great inconvenience in ripening and disposing of the shipment.

According to the requirements of the United States standards for fresh tomatoes, a tomato is considered mature when the contents of 2 or more seed cavities have developed a jellylike consistency and the seeds are well developed. In the practical test a sharp knife should be used and the tomato cut crosswise of the seed cells. If the pulp that surrounds the seeds has become jellylike and the seeds give way before the edge of the knife and are not cut in slicing, the tomato is considered to be mature enough to be shipped. For some varieties the presence of light color or whitish area on the blossom end of the fruit is considered a fairly reliable index of picking maturity. The size of tomato fruits is not a proper guide to the maturity, as it is the age that determines development.

The careful foreman, before issuing instructions to the picking crew, usually selects a number of tomatoes and after slicing them to determine the relation of the external characteristics to the stage of maturity, bases his instructions to the pickers on the rule that seems to apply best. It is difficult to lay down any directions that will be followed closely by the pickers, as their usual tendency is to pick all

fruit that has attained a certain size. However, through close supervision and proper cooperation between the foreman in charge of the pickers and the foreman at the packinghouse, a large proportion of the extremely immature stock which is now received in the markets only to shrivel before attaining normal color might be left on the vines until fully developed.

At the beginning of the season vines should be picked at least once a week and after the season is well under way they should be gone over at least twice a week or preferably every other day in hot weather.

Tomatoes are picked in the pink (sometimes referred to as "turning") and ripe stages in those sections that are comparatively near to the markets. The bulk of the supplies from New Jersey, Michigan, Indiana, Pennsylvania, and Ohio, and a large part of those from New York, Illinois, Virginia, Maryland, and Washington, as well as those from other North Central, Eastern, and Northeastern States, are marketed in these stages. The advent of long-distance truck shipment has increased the volume being marketed in these stages. Even though produced relatively near the markets, tomatoes formerly shipped by rail often did not reach consuming trade channels until 3 or 4 days after picking. Truck transportation makes it possible to move tomatoes several hundred miles overnight and offer them to the consuming trade the morning following harvest.

Recently there has been increased interest in harvesting tomatoes in the pink stage. A comparatively new producing section near Immokalee, Florida, is shipping a large percentage of the crop in the pink stage. In Mississippi there is a State regulation to the effect that: "Any lot of tomatoes offered for sale, shipped, or transported for sale by railway or motor truck, shall contain 50 percent or more by count showing a tinge of color characteristic of a ripening tomato. The remainder of the tomatoes in the lot shall be fully mature-green." This regulation has caused shipments of tomatoes from Mississippi to contain a large percentage of turning fruit. There has also been an effort on the part of some Tennessee growers, in cooperation with the U. S. Department of Agriculture, to arouse interest in harvesting tomatoes in the pink stage in that State.

Tomatoes in the pink stage will naturally hold up longer than those picked in the ripe stage. The term "pink" is applied to tomatoes with red or pink color varying from a trace at the blossom end to a considerable amount of the surface covered. The term "ripe" indicates that most of the surface is covered with pink or red. However, the tomatoes should be firm and should show no indication of softness. It is generally conceded that tomatoes picked in the pink and ripe stages have a better flavor than those picked in the mature-green stage.

Some prepackagers in the markets find that tomatoes harvested in the pink stage can be handled more economically than those that are harvested when mature-green. A large part of such tomatoes is sufficiently well colored on reaching the market so that it can be packaged at once and distributed. The remainder does not have to be held as long in the ripening rooms and thus there is less opportunity for loss-producing disease to develop. Cutting down the proportion of fruit to be ripened and the length of time required for ripening materially reduces the amount of space required for the prepackaging operations. In addition, there is no loss from immature tomatoes

which fail to color properly. All of these factors add up to a more acceptable product at savings that can be passed on to consumers. A better product at a lower price should stimulate purchases of tomatoes, and thus benefit growers as well as shippers and prepackagers.

Tomatoes that are to be marketed in the pink and ripe stages should be picked from the fields every day or two when the ripening season is well under way. Otherwise the chances of getting soft and overripe fruit into the pack are very great.

Picking utensils

Picking utensils of many varieties are used in the various tomato-producing sections. Galvanized-iron buckets and $\frac{1}{2}$ -bushel round stave baskets equipped with wide bails for the comfort of the pickers are among the most satisfactory picking utensils now in use. Various sizes of climax or splint baskets are popular picking containers in some sections, notably in Ohio and New York. Larger types of picking utensils are generally undesirable because pickers have a tendency to set them on the ground and toss the fruit from a considerable distance in order to avoid carrying them about from vine to vine. In New Jersey, Pennsylvania, Maryland, Virginia, and some of the other Middle Atlantic, South Atlantic, and North Central States the $\frac{5}{8}$ -bushel hamper is often provided with a handle and is used for picking. Unless lined with some protective material, this is not regarded as a satisfactory picking container because of the risk of injury to the tomatoes from wire staples which often protrude on the inside of the container. Also some tomatoes in the lower part of the hamper may become bruised or crushed.

Regardless of the shape and size of picking utensils used, the interiors should be inspected carefully and all sharp edges, nail points, and rough surfaces should be smoothed off. Some of the more progressive growers in California and other States have adopted the practice of placing corrugated paper pads or burlap in the bottoms of picking containers to avoid bruising the fruit in handling and to prevent the tomatoes from rubbing on any dirt or sand that may accumulate in the bottom of the containers. Every effort should be directed toward carefully handling, because the small skin breaks, bruises, and abrasions made by sharp or rough edges, although little noticed at the time of packing, may afford an entrance for disease organisms which develop rots or may provide the basis for unsightly scars on the ripened fruit.

Various sizes and types of field crates, baskets, and boxes are in use throughout producing States. A few types are shown in figure 2. In Florida, boxes of about 1-bushel capacity are the most widely used field containers and citrus boxes and $\frac{1}{2}$ -bushel and bushel baskets are used to some extent. Boxes or crates holding about a bushel of tomatoes but with varying dimensions are used in a number of other States, including Alabama, South Carolina, Mississippi, Tennessee, Oklahoma, Arkansas, Kentucky, Colorado, Utah, and possibly some other States. Typical inside dimensions of these boxes are those of one used in Tennessee, which is about 10 inches deep by 13 inches wide by $24\frac{1}{2}$ inches long.



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FIGURE 2.—Three popular types of field containers: Left, the $\frac{5}{8}$ -bushel hamper, used extensively in many of the Eastern States; center, the bushel box, used widely in a number of Southern and Middle Western States; and right, the round-bottom $\frac{1}{2}$ -bushel basket, used to some extent in Florida, Texas, and a few other States.

Some New York growers use a larger field box, approximately 18 inches by 18 inches by 40 inches, as well as tub-type bushel baskets and bushel slatted crates. In several Eastern States, including Maryland, Virginia, Pennsylvania, and New Jersey, growers for the most part use $\frac{5}{8}$ -bushel hampers as picking containers as well as for transporting tomatoes to packing sheds and even to markets by truck. In the lower Rio Grande Valley of Texas, growers who haul their own tomatoes utilize slatted crates having inside dimensions 8 $\frac{1}{2}$ inches by 13 inches by 22 inches. Some shippers furnish crews for harvesting, in which case they use their own shed boxes, which are either 11 $\frac{1}{2}$ inches by 14 inches by 24 $\frac{1}{2}$ inches or 9 $\frac{1}{2}$ inches by 14 inches by 21 $\frac{1}{4}$ inches. In the east Texas district most of the tomatoes are picked and hauled in round-bottom bushel baskets.

Most farmers in the Yoakum district dump their tomatoes directly into pickup trucks or small trailers and haul the tomatoes in bulk to the packing sheds. Lug boxes of various dimensions are mostly used in California for transporting tomatoes from fields to packing houses. Typical dimensions of some of the lugs used are 7 $\frac{1}{2}$ inches by 14 inches by 22 inches, 8 $\frac{1}{2}$ inches by 14 inches by 17 $\frac{1}{2}$ inches, and 6 inches by 15 inches by 21 $\frac{1}{2}$ inches. Many growers also use the standard lug box as a shipping container which without cleats is 5 $\frac{3}{4}$ inches by 13 $\frac{1}{2}$ inches by 16 $\frac{1}{2}$ inches inside. In Kern County, four-wheeled trailers are used for bulk transportation of tomatoes from fields to packing sheds. Tomatoes grown in Washington are ordinarily hauled either in lug boxes about 6 $\frac{3}{4}$ inches by 14 inches by 20 $\frac{1}{2}$ inches, or in standard apple boxes 10 $\frac{1}{2}$ inches by 11 $\frac{1}{2}$ inches by 18 inches.

Recent years have witnessed the passing of some of the larger unwieldy types of field containers formerly used in some States. Field crates and boxes should preferably be light in weight but should be durable and should be equipped with cleats across the top at each

end to prevent bruising the fruit in stacking. If possible they should be made from dressed lumber, as tomatoes receive more or less bruising and abrasion when hauled in containers made from unplanned material. Boxes should be provided with handholes to facilitate handling.

Picking

The grower and members of his family are usually able to pick the tomato crop when the acreage is small, but the producer of a large acreage must hire crews of pickers to work under his or his foreman's direction. In many of the more important producing States, particularly in the South and West, much of the labor employed in picking tomatoes is migratory. Many growers pay a uniform daily wage, whereas others prefer to pay on the basis of the quantity picked. Both methods have advantages and disadvantages. Under the set daily wage system pickers are likely to follow instructions more carefully and to pick only those tomatoes that have reached the right stage of maturity. Pickers paid on the basis of the quantity picked are likely to sacrifice quality for quantity unless they are closely supervised.

In picking, the tomato should be grasped in the hand, with the thumb or forefinger pressing against the stem in such a manner that the stem and calyx are separated from the tomato by a half turn or twist. Tomatoes are easily separated from the vine, even at the mature-green stage, as a layer of hard-walled or corky cells develops at the union of the stem and the fruit. This layer forms on the outer rim of the stem and extends inward; after the tomato is picked this layer appears as a brownish ring in the stem-eye. In sorting operations the width of the ring is sometimes used as an indication of the maturity of green tomatoes, and specimens that show a very narrow brownish ring or have a greenish-white cast in the entire stem-eye area are discarded as being immature.

Preferably one row, or two at the most, should be assigned to each picker, so that picking containers will be within convenient reach. Care should be exercised to prevent bruising the fruit in transferring it from the picking utensil to the field container. In dumping, the picking container should be so tilted as to permit the tomatoes to roll gently into the field container.

Short rows, and a generous distribution of field containers at the roadway or ends of the rows, increase the daily output by decreasing the distance the picker must carry his filled basket. Cross roadways should be made at regular intervals if the rows are exceptionally long or, if this is impracticable and the vines are staked, the field crates may be placed on a long sled and drawn between the rows. If the packing shed is adjacent to the field, the filled containers are hauled directly to that point. Otherwise they are left at the end of the rows and placed on a truck for hauling to the packinghouse.

The hauling of tomatoes in bulk from fields to packinghouses in beds of trucks or trailers, as is done in some districts of Texas and California, is not regarded as good practice. It may be labor saving, but tomatoes so handled are subject to more or less rough treatment in loading and unloading. The bruising that results, although it may escape the scrutiny of the sorters, seriously injures the appearance of the tomatoes after they have ripened, and final returns for the

tomatoes may offset any labor-saving costs in this method of handling.

Growers of greenhouse tomatoes follow a slightly different practice in picking tomatoes than do growers of field-grown fruit. Instead of twisting the tomato from the vine, most of the greenhouse growers clip the stem just above the calyx, thus leaving the calyx and a small portion of the stem attached to the tomato. This practice is followed in order that the tradesmen and consumers may be able to distinguish greenhouse-grown from field-grown fruit. Ripe greenhouse-grown tomatoes with the stems and calyxes attached present an attractive appearance, but unless great care is used in handling and packing, some tomatoes may be punctured by the stems of other tomatoes.

Farm packing

Packing of fresh tomatoes on the farm by the growers is gradually giving way to packing in centralized packinghouses by experienced sorters and packers. Farm packing is now largely confined to producing areas in the North Central and Eastern States where the tomatoes are for the most part hauled by truck and marketed in the pink and ripe stages. In the Marietta district in southeastern Ohio, however, most of the fresh tomatoes are prepared for market in central packinghouses.

Although improvement has been noted in the quality of farmers' packs in recent years, there is often a wide variation in the quality of individual grower's lots. In many cases sizing is irregular and the arrangement of the fruit in the packages is frequently uneven, loose, and unattractive.

Sorting and packing equipment on small farms is often very crude. Operations are frequently carried on in the shade of a tree or under a temporary roof made of canvas or boards supported at the corners by poles. Even though the shelter provided is not weatherproof there is no excuse for not providing for careful handling of the tomatoes.

A waist-high packing bin about 30 inches wide, 8 inches deep, and several feet long with a wire-net bottom covered with canvas or burlap should be provided. If the bottom of the bin is made of boards it should be well padded with burlap or some other soft material. A packing bench should be constructed along one side of the bin.

Central packinghouses

A marked improvement has been evident during recent years in the quality of fresh tomatoes offered for sale in the markets. Much of this improvement can be attributed to the increased volume that is sorted and packed in central packinghouses by experienced sorters and packers instead of being packed at the farm by the grower and members of his family. Practically all green-wrap tomatoes from California, Florida, Texas, Tennessee, and Mississippi, and from many of the less important producing States are now prepared for shipment in central packinghouses.

Central packinghouses usually are operated by individuals or firms that buy tomatoes, delivered at the packinghouse, from growers. However, in some instances the packinghouses are operated by growers' cooperative associations or by individual growers who control large

acreages and perform the functions of both grower and shipper. Local buyers either purchase the unpacked tomatoes in field containers or arrange with the grower to act as selling agent and to market the crop on a consignment basis after making a fixed charge per package for sorting and packing. The central packinghouses are largely responsible for placing a fairly well-standardized product on the markets. Usually their operations are on a scale sufficiently large to permit a division of labor and adequate supervision. The managers are in a position to maintain experienced sorters and packers, who are essential to the packing of a uniform and high-quality product.

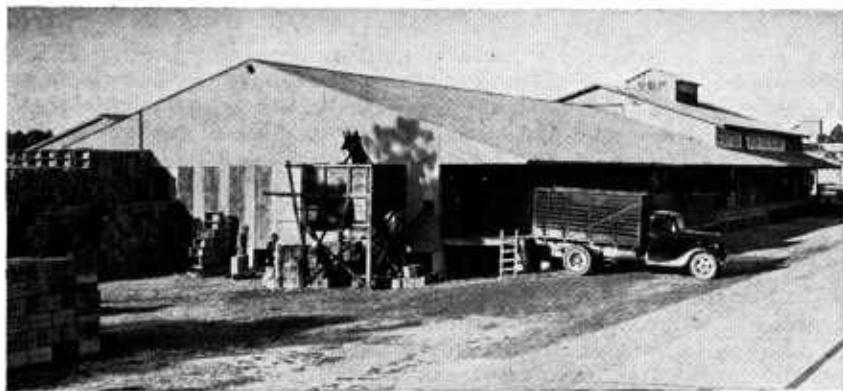
Location

In producing sections where the crop is to be shipped by rail it is preferable that the packinghouse be located alongside the track or spur track. Many tomato packinghouses are so located, in or near small towns and villages. Packed fruit can be loaded directly into the cars, and packinghouse employees who live in the village need not be transported to the packinghouses in the country.

Locating the packinghouse on a railroad siding is not always feasible if the producing section is located some distance from the railroad. Under such conditions it may be best to locate the packinghouse close to the fields and transport the packed fruit by truck to the railroad. In moving the tomatoes, there is less likelihood of injury to fruit packed in containers for shipment than to unpacked fruit in field crates.

Important construction features

Most of the tomato packinghouses are rectangular, frame or galvanized-iron buildings of various dimensions, usually from 35 to 50 feet wide and 60 to 150 feet long (fig. 3). Some are one story and others are two stories high. The penthouse type of construction is often employed in the two-story buildings. In the two-story houses the



AMS 2548

FIGURE 3.—Unloading mature-green tomatoes from a truck at a typical Florida vegetable packinghouse. After growers unload filled boxes they pick up empties, shown stacked at the rear of the house.

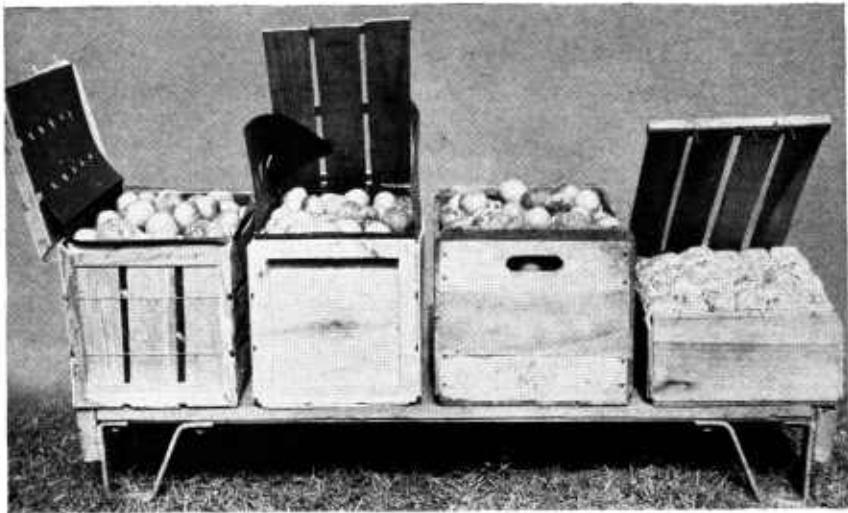
upper story or loft is generally used for the construction and storage of lug boxes, which are supplied to the packers on the lower floor by means of slides or chutes. The lower floor should preferably be constructed at approximately the same height as a truck floor, or the floors of refrigerator cars if the house is on a railroad siding. In many instances covered platforms materially enlarge the protected area for storage purposes but have the disadvantage of shutting off the light from the interior of the house.

Regardless of size or capacity, the well-constructed packinghouse should provide for adequate ventilation, good light, and ample storage space. Good ventilation is essential because most tomatoes are packed during warm weather. If the packing space is not enclosed or if large sliding doors and windows are provided, the problem of ventilation is relatively simple. Circulation of air may be increased by providing slatted floors, but, as they are not easy to truck over, a better arrangement is to provide solid floors in the trucking alleys and slatted floors over the storage space.

An abundance of light is needed for the sorting operations, because such defects as immaturity, worm injury, and certain types of disease do not show conspicuously on the green or red surface of the tomato when the fruit is in shadow. The method of providing illumination depends on the interior arrangement of the house. Where the sorting and packing operations are performed along the side or end of the building, sliding doors or high windows may be placed along the side walls, but with this arrangement some of the workers are likely to stand in their own light. Some packinghouse managers prefer to carry on the sorting and packing operations in the central part of the house. This is generally satisfactory if this section of the house is amply lighted by artificial light or if large skylights or windows in a penthouse type of roof are provided. In the latter type of construction the penthouse structure should be at least 10 feet in height. In houses provided with lofts for the storage of crate material and lug boxes, shafts or walls are sometimes used to admit light and concentrate it directly over the sorting tables. The interior of these shafts should be painted white to intensify the illumination.

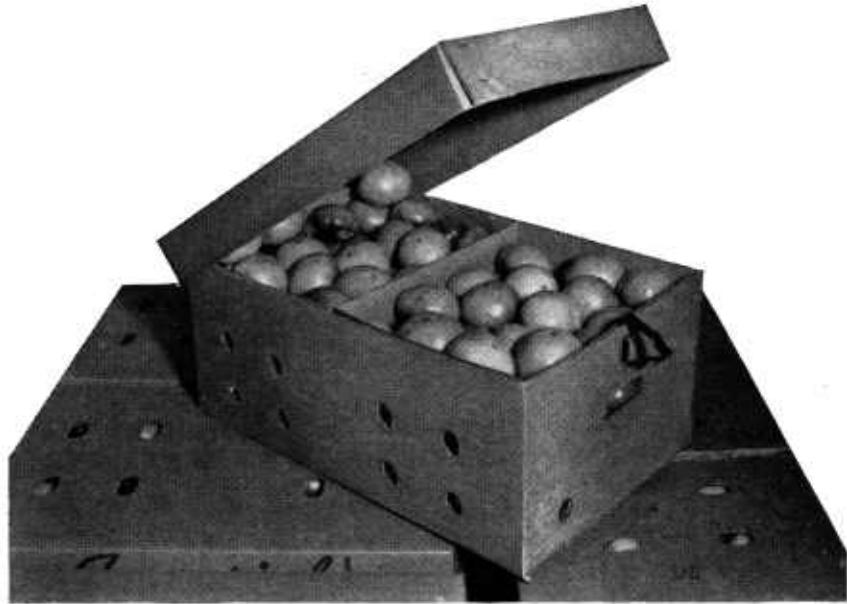
Packages

The most suitable package to be used in marketing fresh tomatoes depends largely on the method of transportation to market, the stage of maturity at which the tomatoes are marketed, relative costs of the packages, market preferences, and the kind of labor available. The lug box has long been the most popular package for long distance shipment of green-wrap stock. However, during recent years, the trend has been toward loose-packed fruit. The lug box of wrapped fruit is giving way to wire-bound crates, nailed crates, and fiberboard boxes, jumble-packed with unwrapped tomatoes. The lug box and the other containers which are now widely used are shown in figures 4 and 5. Other packages of minor importance from the national standpoint, but of considerable importance in local producing districts, are the 12-quart climax basket, the western peach box, the $\frac{1}{2}$ -bushel hamper, the $\frac{1}{2}$ - and 1-bushel round stave baskets, the 8-, 12-, and 16-quart corrugated fiberboard and square-braid splint baskets, the 8-, 12-, and 16-quart diamond-weave splint baskets, and the 25- and 50-pound boxes.



AMS 19730

FIGURE 4.—Shipping containers for mature-green tomatoes. Left to right: Wire-bound crate, nailed crate, and field crate, each jumble-packed with approximately 60 pounds of tomatoes, and a lug box place-packed with approximately 32 pounds of tomatoes.



AMS 20213

FIGURE 5.—The fiberboard box, jumble-packed with approximately 40 pounds of tomatoes, is a popular shipping container. The center partition strengthens the box and provides additional protection against bruising.

The lug box

The lug box shown in figure 4 has practically displaced all other types of packages for the shipment of wrapped mature-green tomatoes. It is important in shipments, by rail and by truck, from California, Florida, Texas, Tennessee, Mississippi, the Eastern Shore of Maryland and Virginia, and from other, less important producing States. This lug, often referred to as the Los Angeles lug, is $13\frac{1}{2}$ inches wide, $16\frac{1}{2}$ inches long, and $5\frac{3}{4}$ inches deep, inside measurements. A cleat $1\frac{1}{16}$ inch thick is used at each end of the lug to protect the tomatoes from pressure by the lid. Some shippers prefer to use a narrow cleat of a width corresponding to the thickness of the end piece of the lug; others use a cleat which is wider and extends inward beyond the end piece. Wide cleats often have the inside lower edge rounded to prevent cutting and bruising of adjacent fruit. Although the above dimensions of the package and cleat are given as standard, lugs of slightly different dimensions are sometimes used in some sections. A variation of this lug is widely used in California for wrapped-pack tomatoes. This lug has the same width and length as the standard lug but it is $7\frac{1}{8}$ inches deep, or the depth of the Los Angeles lug when two $1\frac{1}{16}$ inch end cleats are used.

When the lug is substantially constructed, its rectangular shape permits easy loading in the cars. The lug is designed to hold three layers of medium- or large-sized tomatoes which weigh about 30 pounds net.

The use of the lug has encouraged more careful sorting and sizing of the fruit than is commonly practiced when the fruit is packed without any order of arrangement. Each tomato is handled separately by the packers. The definite arrangement of the fruit within the lug contributes to its attractiveness and minimizes the danger of bruising.

The lug pack is more expensive than most other types because the services of experienced packers are necessary to insure properly packed lugs. General overhead for packing is also higher because this type of pack is prepared almost exclusively in central packinghouses. Considerable volume is essential to insure profitable operation of the packinghouse where the lug pack is employed.

Containers for loose-pack tomatoes

During recent years an increasing proportion of the green tomatoes shipped to the fresh market have been loose-packed. The lug is used to some extent for loose-pack fruit but larger containers are in more general use. These containers, with the approximate inside dimensions, are as follows:

1. 60-pound wire-bound crate, $18\frac{1}{2}$ to $20\frac{1}{2}$ inches long, $11\frac{15}{16}$ inches wide, and $11\frac{15}{16}$ inches deep;
2. 60-pound nailed crate, $18\frac{1}{2}$ to $20\frac{1}{2}$ inches long, $11\frac{3}{4}$ inches wide, and $11\frac{3}{4}$ inches deep;
3. Field crate, $22\frac{1}{4}$ inches long, 11 inches wide, and 11 inches deep;
4. 40-pound fiberboard box, $19\frac{1}{2}$ inches in length, 12 inches in width, and 8 inches deep.

These measurements may vary somewhat in different areas. The popularity of the individual containers also varies with the area. For example, in Florida the order of their popularity is as follows: Wire-bound crate, nailed crate, field crate, fiberboard box, and lug

box. In California the wire-bound crate is most widely used for loose-pack tomatoes. A variety of other containers including apple boxes, field crates, and second-hand beer cases are also used. Wire-bound crates are also widely used in Texas, Mississippi, New York, and on the Eastern Shore of Maryland and Virginia for loose-pack fruit. The fiberboard box is being used in most producing sections.

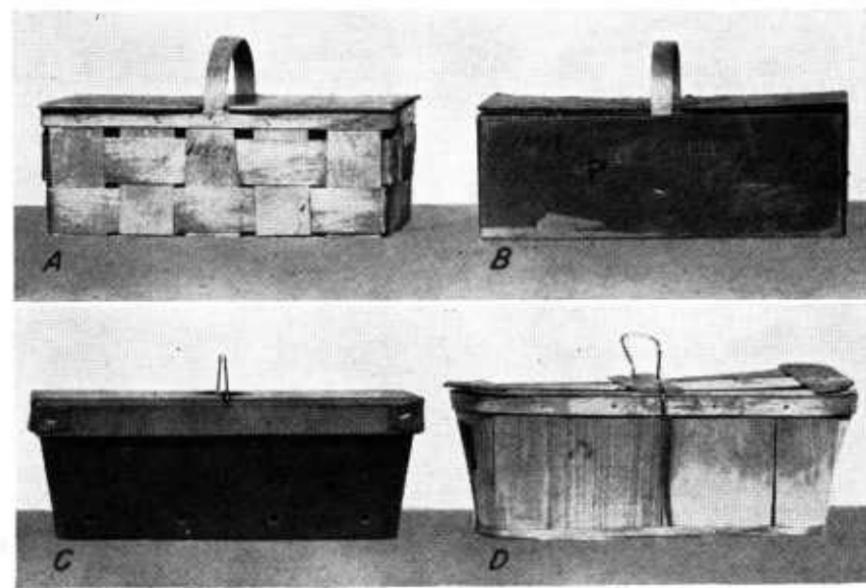
With the use of these bulk containers the operators use some special type of equipment in the packinghouses to fill the containers quickly. Less skilled labor is needed under these circumstances. The fruit is not wrapped and, in general, it is a more economical operation. The wire-bound and nailed crates are provided with cardboard liners which protect the fruit from contact with the container.

The prepackagers frequently use the containers in which the green fruit is received as master containers for shipment of the packaged, ripe stock to retail outlets. Some fiberboard boxes have the added advantage that they can be folded flat, thus taking up less space, and can be economically returned to the shipper to be re-used.

Tomatoes harvested in the pink stage are shipped in a variety of containers. In California they are shipped to local markets in lugs. In Florida they are packed in lugs, crates, and cartons. Mississippi tomatoes, required by State regulation to contain at least 50 percent "pinks" are usually packed in lugs for long-distance shipment.

Fiberboard and splint baskets

The use of fiberboard and splint baskets with handles over the top (fig. 6) as containers for shipments of pink and ripe tomatoes to mar-



AMS 15827

FIGURE 6.—Types of overhandle baskets used extensively for marketing pink and ripe tomatoes in the East North Central States: *A*, square-braid splint basket; *B*, upright-type fiberboard basket; *C*, nesting-type fiberboard basket; *D*, climax basket. The square-braid splint and fiberboard baskets are made in standard 8-, 12-, and 16-quart sizes, the 8-quart size being the most popular. Climax baskets used for tomatoes are of standard 12-quart capacity.

ket has been steadily increasing for a number of years. Greenhouse growers, particularly in the East North Central States, were the first to popularize the square-braid splint basket of 8-quart capacity many years ago. A little later they began to use an overhandle fiberboard basket of about the same dimensions. Use of these packages has gradually extended to field-grown fruit. In Ohio the bulk of both hothouse and field-grown stock now moves to market in the 8-quart fiberboard basket. More recently fiberboard and square-braid splint baskets of 12- and 16-quart capacities have been used to some extent in the East North Central States as containers for tomatoes.

Market baskets also have been popular containers for local shipments of tomatoes as well as for other products in some of the Southern States. Baskets generally used for tomatoes are 12- or 16-quart diamond-weave splint baskets with overhandles, although some 8-quart baskets also are used (fig. 7). Pink and ripe stock is generally packed in these containers, which are transported to market mostly by truck.



AMS 15131

FIGURE 7.—Diamond-weave, overhandle splint baskets of standard 8-, 12-, and 16-quart capacities are used to some extent for marketing tomatoes locally in some Southern States. The 12-quart size is the most popular one.

Because of their small size and convenient handles these various types of market baskets are well adapted to selling tomatoes to consumers without disturbing the contents. The fiberboard baskets also lend themselves to the stamping of brands and other information in attractive colors.

The 12-quart climax basket

The 12-quart climax basket shown in figure 6 is used in several of the Northern States, including New Jersey, Pennsylvania, New York, Michigan, and Indiana. The tomatoes marketed in this container are usually picked in the pink or ripe stages. The package is readily prepared by inexperienced packers and is a convenient and popular size for sales direct to consumers. Although the tomatoes are protected by a slatted cover, the packages must be handled carefully to minimize damage to the contents. As the baskets are somewhat flexible, bruising and cutting may result from undue pressure or rough handling. Most of the tomatoes packed in this type of container are transported to market by truck.

The western peach box

The western peach box is used to some extent in Washington and Oregon as a container for pink and ripe tomatoes packed for nearby markets. This container, which is 11½ inches wide, 16 inches long, and 4½ inches deep, is strongly built and convenient to handle.

The 5½-bushel hamper

The 5½-bushel hamper, in addition to being used extensively throughout the Eastern and East North Central States as a picking container and for transporting tomatoes to canneries, is commonly used for carrying pink or ripe tomatoes to market by truck, particularly from points in Pennsylvania, Maryland, Virginia, and New Jersey to nearby markets (fig. 2). This hamper is regarded as an unsatisfactory container for long-distance shipment, as its open-stave construction does not adequately protect the contents from mechanical injury and bruising in hauling and handling. In addition, it is usually not covered and care must be used in filling the hamper in order to avoid crushing the top layer of tomatoes.

Round stave baskets

Round stave baskets usually of ½- or 1-bushel capacity are used to some extent as containers for transporting pink or ripe tomatoes to local markets in the Eastern and East North Central States (fig. 2). They have the same disadvantage as other packages of considerable depth in that the weight of the fruit may crush some of the ripe tomatoes in the bottom of the packages.

The 25- and 50-pound boxes

Containers that have recently come into use include the 25- and 50-pound wooden boxes used in Atlanta, Ga., for repacking tomatoes for distribution to wholesale and retail outlets in Atlanta and smaller towns and cities in the surrounding territory. Most of the tomatoes received in Atlanta are repacked in these containers before being distributed. Much of the stock from nearby areas is delivered to the repackers in field boxes by truck. During off seasons many rail receipts of tomatoes from more distant States, packed in lug boxes, are repacked. The 25-pound box is 9 inches wide, 16 inches long, and 8 inches deep, and the 50-pound box is 10½ inches wide, 20½ inches long, and 10 inches deep. Paperboard dividers are used between each layer of fruit to prevent bruising and mashing.

Packinghouse equipment

Not many years ago tomatoes were generally sorted and sized by hand and the important pieces of equipment in packinghouses were the packing and sorting bins. Today the up-to-date packinghouse presents an entirely different appearance, with the addition of several machines and labor-saving devices arranged in a continuous line and designed to handle a large volume of tomatoes at a minimum of cost.

In most of the more important producing States that ship mature-green stock, it has become the general practice for shippers to wash tomatoes before packing them for shipment. This has resulted in the installation of washing and drying machines in packinghouses. Many shippers in these States also have installed waxing machines which apply a thin coating of wax over the entire surface of the fruit for the purpose of preventing excessive shriveling.

Sorting from field containers or sorting bins in many States has been outmoded by sorting from roller-conveyor units or moving belts, where the sorters standing on either side remove defective tomatoes and separate the remainder into various grades. Sizing entirely by hand is no longer practiced by many in States that ship mature-green tomatoes. Most shippers in these States have installed mechanical sizing machines in their packing lines to divide the tomatoes into at least four different size classifications. Another labor saver found in many of the larger packinghouses is an electrically operated lidding machine which does away with hand nailing of lids of lug boxes and crates.

There is some question whether the recent widespread installation of mechanized equipment in tomato packinghouses has resulted in sending better quality tomatoes to market. Tomatoes which run the gauntlet over a long line of roller conveyors and through various machines are subject to more or less bruising and rubbing. The injury may appear very minor or may not even be noticed at the time of packing, but may well be the source of infection by disease organisms or may cause discoloration which will make a tomato worthless on arrival in the markets. It is argued that tomatoes that are handled carefully, sorted and sized by hand, and packed from well-padded bins directly into containers for shipment, as is still the practice in some sections, receive considerably fewer bruises and abrasions than tomatoes that are passed over the mechanized equipment of the modern packinghouse.

In the installation of packinghouse equipment, care should be taken to see that each unit is properly fitted in the line, in order to minimize mechanical injury to tomatoes. Any projections or rough edges should be padded with pieces of composition or rubber belting or similar material. Attention to such details often pays big dividends in preventing injury to tomatoes.

Washing and waxing equipment

During rainy periods, soil is often splashed on tomatoes. The sandy particles adhering to the surface of the fruit cause mechanical injury in the form of sand scarring if the tomatoes are handled much without being washed. For this reason and to improve their appearance it is almost necessary to wash them before they are packed. Also the tomatoes on the tops of containers become more or less coated with dust during transportation from the fields to packinghouses; this likewise injures their appearance. As a result of these conditions most packinghouse operators now consider the washing machine necessary equipment and all tomatoes handled through their packinghouses are washed. In Florida, Texas, California, and Tennessee the crop is generally washed before packing for shipment. A large part of the crop in some of the smaller producing States which ship green-wrap tomatoes is also washed.

When tomatoes are washed the washer generally is the first machine installed in the line. Usually there is a hopper at the head of the machine into which tomatoes from the field containers are poured. From the hopper the tomatoes are picked up by a roller conveyor which continues through the washer. These machines are not standardized but usually consist of a tank covered with a hood which is filled with water. Others simply contain a number of spray nozzles which spray the tomatoes as they pass along on the rollers (fig. 8). In the types of machines in which the tomatoes are submerged in a bath, various trade-named washing solutions are generally used. Some shippers give the tomatoes a warm bath with a temperature of about 110° F. to which a borax-soap solution has been added. Others sometimes use a cold hypochlorite solution containing 50 to 100 p. p. m. available chlorine. When washing solutions are used, the tomatoes are generally rinsed with a clear water spray as they emerge from the tank on a conveyor. Washing the tomatoes before they are sorted enables the sorters to detect and remove many defective specimens which otherwise might be missed.

When tomatoes are washed, it is absolutely essential that they be dried before they are packed; otherwise the moisture would discolor the wrappers. Therefore most shippers who use washing machines, have also installed driers in which the tomatoes are dried from air circulated by electrically driven fans. In houses where the tomatoes are waxed, the tomatoes are conveyed from the washer directly to



AMS 15710

FIGURE 8.—In this Texas packinghouse, tomatoes are washed by means of sprays from a series of nozzles before passing on a roller conveyor before the graders, who are shown at work in the right background.

the waxing machine. As the tomatoes pass through the machine a very thin coating of wax is applied to the tomatoes by one of several different processes and types of machines now on the market and sold under certain trade names. In some types of machines the tomatoes are coated with wax by passing them through a bath containing a wax emulsion. In other types, a hot-wax, a solvent-wax, or even a dry-wax process is used. Most of such machines are equipped with drying fans to remove moisture from the surface of the tomatoes before they pass on to the packing belts or bins.

Sizing machines

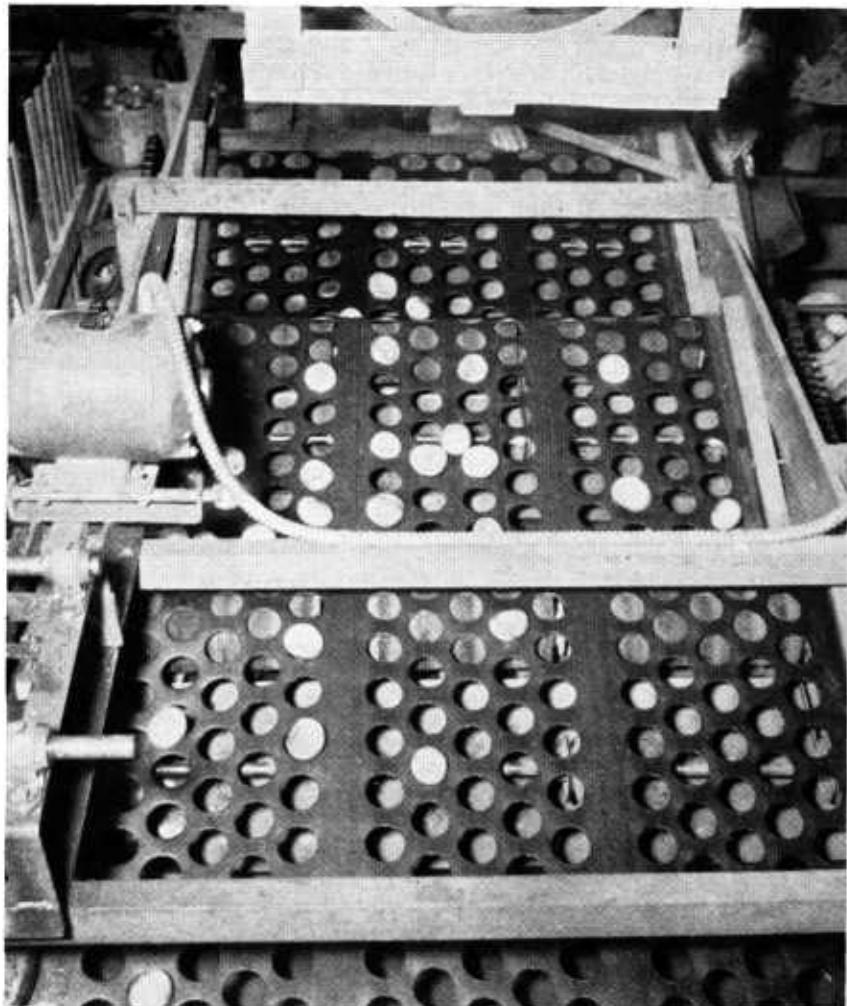
Most of the shippers in States that ship mature-green tomatoes now use mechanical sizing machines to size the tomatoes. During the last 15 years there has been a phenomenal increase in the installation of such machines in packinghouses. Machine sizing of tomatoes picked in the pink and ripe stages is usually not practicable because of the danger of causing mechanical injury. Thus, in the northern producing States there is very little machine sizing because most of the tomatoes are marketed in the pink or ripe stages.

The type of machine now in general use for sizing tomatoes is shown in figure 9. The construction of the sizing belts varies with different manufacturers. Some machines are equipped with rubber-covered or composition belts. Others have rubber-covered steel belts provided with round openings and some belts are of steel and have square openings. The complete equipment of the machine consists of two units, a sorting unit and a sizing unit. In houses where tomatoes are washed and waxed these units are usually installed in the line immediately following the washing and waxing machines. If these machines are not used, a hopper about waist high is placed at the head of the sorting unit to receive the tomatoes from the field containers. The tomatoes roll from the hopper onto the sorting unit, which consists of a series of rollers set on an incline of about 30° . From 3 to 5 sorters are stationed on each side and as the tomatoes move up this incline the rollers turn the tomatoes, thus enabling the sorters to see and remove defective tomatoes more readily. A conveyor belt running lengthwise through the center of the unit carries off the cull fruit.

As the tomatoes reach the end of the sorting unit they roll onto the sizing unit. The typical sizing unit consists of a series of 3 wide rubber-covered continuous belts which are perforated with round holes at regular intervals. There is a difference of about one-fourth inch in the diameter of the holes in the 3 belts. The first removes the smallest tomatoes, the second the next larger size, and the third a still larger size. The largest tomatoes, which do not pass through any of the holes, drop off the end of the third belt. Some sizing units have 4 belts instead of 3.

A recent development, particularly in Florida and California, is the use of "resizers" to obtain more uniform sizing. The resizer consists of an additional series of small sizing belts over which the sized tomatoes are passed before being moved to the packing bins. The holes in the resizer belt are one size smaller than those in the belt through which the fruit has just passed. A sizing unit with 4 belts having perforations measuring $2\frac{1}{2}$, $2\frac{2}{3}$, $2\frac{3}{4}$, and $3\frac{1}{2}$ inches will deliver tomatoes that can be packed in size arrangements of 7 x 7, 6 x 7, 6 x 6, and 5 x 6, respectively. Resizing belts are provided for

the last 3 belts of the main sizing unit. For example, tomatoes that pass through the $2\frac{9}{32}$ -inch belt drop onto a resizer belt having $2\frac{10}{32}$ -inch perforations, those that pass through the $2\frac{8}{32}$ -inch belt drop onto a $2\frac{9}{32}$ -inch belt, and those that pass through the $3\frac{1}{32}$ -inch belt drop onto a $2\frac{3}{32}$ -inch belt. Tomatoes that do not pass through a resizer belt are conveyed directly to the packing bin for the size selected by the main belt, and tomatoes that do pass through a resizer belt go to the bin for the next smaller size. Usually the resizer belt replaces the cross transfer belt which conveys the sized tomatoes either to conveyor belts leading to packing belts or to continuous belts from which packers select tomatoes for packing in containers. The packing of containers by selecting tomatoes directly from continuous belts represents the latest development in packing wrapped mature-green tomatoes.



AMS 15704

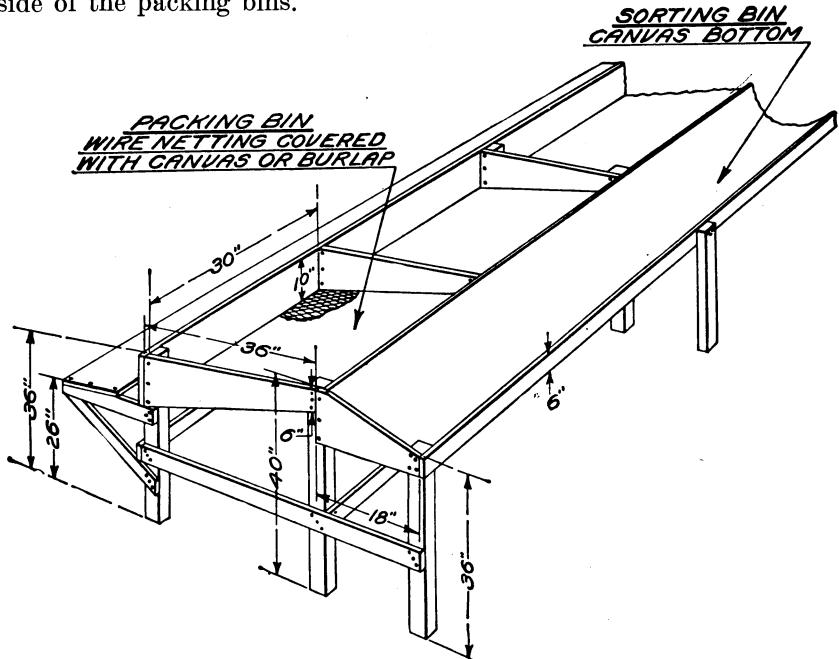
FIGURE 9.—View looking down on a sizing unit consisting of a series of continuous belts; each series is perforated with different-sized round holes. This type of sizing machine is now widely used by shippers in important producing States.

Sorting and packing bins

Even though mechanical sizing machines are now widely used in most of the important shipping States, many shippers still have not installed the continuous-belt system, and the packing bins are important units of equipment in the packing line. Also, where hand sorting and sizing are still practiced, as is the case in some of the less important producing States, the sorting and packing bins are the most important pieces of equipment.

Packing bins should be so designed that all the tomatoes in the bin are within convenient reach of the packers. It should not be necessary for the packer to rake or pull the fruit toward him. A very satisfactory design for packing and sorting bins is shown in figure 10. The packing bins should be about 6 inches deep at the back, 30 to 36 inches wide, and 36 to 48 inches from back to front, depending on the pitch of the bin floor towards the packer. The bottom of the bin is usually made of wire netting of about 1-inch mesh, stretched tightly and covered with burlap or canvas. The number of bins needed will depend on the volume of tomatoes handled. In some instances specially constructed bins have been installed which have movable bottoms hinged at the upper or the sorter's side and supported by coil springs at the packer's side. As the fruit is removed, the bottom of the bin is raised so that a supply is always within easy reach of the packer.

If a sorting bin, such as the one illustrated in figure 10, is used it should be about 18 inches wide and 6 inches deep. The bottom of the sorting bin should be made of canvas or burlap, similar to the bottom of the packing bins. If the tomatoes are to be sorted directly from the field containers, a bench can be attached to the sorter's side of the packing bins.



AMS 7794

FIGURE 10.—Type of sorting and packing bin in general use when grading is done after the field crates are emptied into a sorting bin.

Operation of a packinghouse

Competent and careful supervision is necessary in the successful operation of a tomato packinghouse. The foreman in charge should be thoroughly familiar with the standards under which the tomatoes are packed and the various methods used for packing different sized tomatoes in the containers. He should be able to train employees in the art of sorting and packing as well as to detect quickly any employee who is not doing his work properly. The failure of one or two employees to do their work in accordance with the standards set by the establishment may mean a considerable loss to a firm when final returns are calculated.

In most of the larger producing sections professional packers are employed. This is particularly true in southern and western areas where professional fruit packers move from place to place as shipping seasons progress. In many smaller producing areas local packers have proved to be more satisfactory than the professional who moves from place to place. Local help is usually more responsible and much easier to handle.

Movement of the tomatoes through the house

Packinghouse equipment should be located within the house so that the minimum amount of labor is required in handling the tomatoes. Usually the movement will be across the width of the house, as the driveway and receiving platform will be along one side and the railroad tracks or driveway for receiving packed fruit will be on the opposite side. If the house is located on a railroad siding and an adequate supply of cars is always available, storage space for packed containers need not be so great. In this case it would probably be best to locate the packing equipment lengthwise toward the track side of the house. This will leave ample space for receiving or stacking the unpacked fruit as it is delivered by the growers on the opposite side of the house, and the packed fruit will only have to be transported a short distance to the cars.

If the packinghouse is not on a railroad siding, or if for any reason a considerable amount of storage space for packed containers is needed, it would probably be best to locate the equipment lengthwise through the center of the house if adequate light can be provided.

Packinghouses that were built a number of years ago are often not long enough to have all the latest equipment arranged in a continuous line. Fortunately, manufacturers of tomato-packing machinery have recognized this fact and most of it can be adapted to arrangement in any type of house. In some houses it may be advantageous to arrange certain units, such as the washer and sizing machine, across the width of the house at one end and then extend the sorting conveyor and packing line lengthwise.

Receiving the fruit

An experienced employee should have charge of receiving the loose fruit from the growers. When tomatoes are bought at a flat price per field crate, he should make whatever deductions are necessary for

poorly filled crates or improperly picked stock. In some sections purchases are usually made on a packed-lug basis. If the packinghouse is run on a cooperative basis, each lot should be tagged to show the grower's name and number of packages. As the various lots are sorted and packed, a statement of the number of lugs of each grade and size is added and the tag is sent to the office for the permanent record. Perhaps the most important duty of the receiver is to encourage growers to insist on proper care in picking and handling. When this phase of the work is overlooked, the cost of sorting is increased and frequently immature and badly blemished fruit is included, which results in a heavy loss.

The use of clamp or platform trucks or ordinary grain hand trucks to move the tomatoes from the unloading platform to the point where they are to be washed or sorted is an important labor-saving device employed in most packinghouses. The type of truck used will depend largely on the kind of container in which the tomatoes are delivered to the packinghouses. The truck may also be used to transfer the packed lugs to the loading platform or to the cars. However, most up-to-date houses are now equipped with roller conveyors which transfer the lugs from a point near the lidding benches directly to the cars or to the side of the house for stacking.

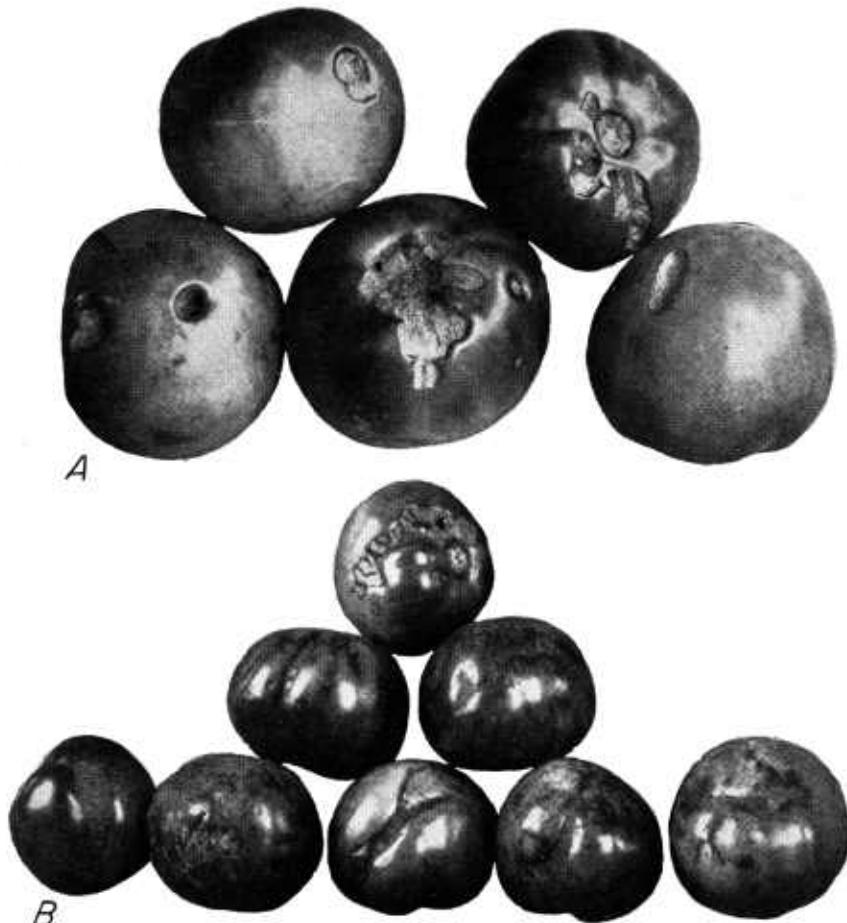
Sorting and sizing

Tomatoes are sorted by hand labor for market quality and defects. They are also sized entirely by hand in houses where sizing machines have not been installed.

In the more modern packinghouses, where equipment is mechanized, the sorters are stationed on either side of the sorting unit which is usually installed just ahead of the sizing machine. The sorting unit may be of the roller-conveyor type or simply a wide belt. The former is advantageous in that the tomatoes are turned as they move along the unit and this enables the sorters to see all parts of the tomatoes. Tomatoes which move on conveyor belts are not turned unless the sorters roll them over by hand, and the sorters may miss some of the defective ones. However, there is probably less rubbing and skin abrasion when the tomatoes are conveyed on belts rather than on roller conveyors.

Packinghouse operators claim that sorting from conveyor belts or roller conveyors enables a smaller number of sorters to do the same amount of work, gives greater uniformity in the quality of stock in the packed containers, and provides a better distribution of fruit to the packers. Sorters should be arranged along the sorting unit according to their proficiency, the most experienced members of the crew giving the final inspection. Sorters should be given thorough instruction by the foreman or someone well acquainted with the requirements of the grades being packed. They should be shown the various types of defective and diseased tomatoes which should be sorted out and a close check should frequently be made of their work to see that instructions are being followed.³ Various types of defective tomatoes are illustrated in figures 11, 12, and 13.

³ Farmers' Bulletin 1934, Tomato Diseases.

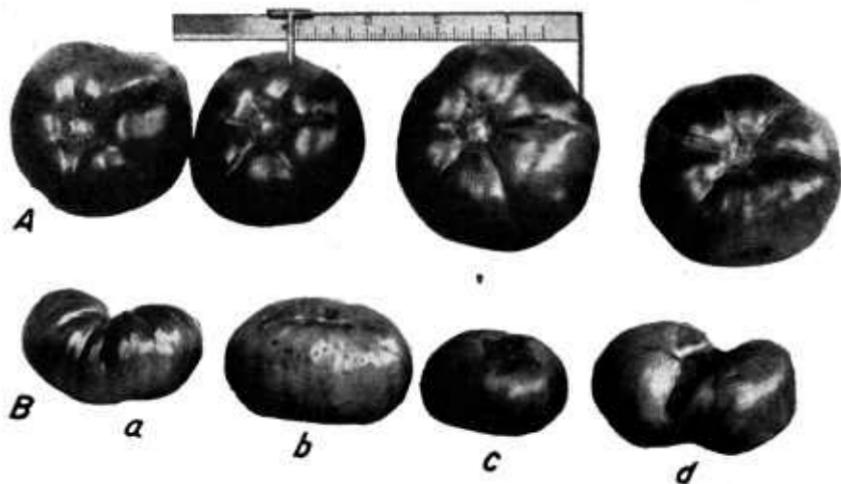


AMS 7695A, 7702

FIGURE 11.—Worm-eaten tomatoes (A) and those injured by large stake or wind scars (B) should not be packed with the first-grade stock.

In packinghouses that have not been mechanized, the sorters are usually stationed along one side of a series of bins and the packers work on the opposite side. Many packinghouse operators, however, prefer to have the employees sort the tomatoes directly from the field containers instead of first dumping the tomatoes into sorting bins. They claim that the tomatoes are subject to less handling and so are less likely to become bruised. Sorting from the field containers also means less space in the packinghouse for the sorting operations.

Those packinghouse operators who dump the tomatoes into sorting bins before they are sorted contend that the sorters have more freedom of action and a better opportunity to see the blemished fruit than when they are sorted from the field containers. If mature-green stock is being packed, the pink or ripe tomatoes are placed in field crates and carried to special packers or placed in separate compartments of the bin. The fruit that is satisfactory for packing is placed in the packing bins directly in front of the sorters.



AMS 7700B, 7695B

FIGURE 12.—Tomatoes (A) showing deep stem-end or growth cracks and those (B) that are rough or extremely kidney shaped (a), or that show large scars and catfaces (b, c, and d) should be sorted from the first-grade stock.

In some packinghouses the sorter also does the sizing. As he handles each tomato he gages the size by eye and places it in the bin intended for that size. In other packinghouses the sorters merely separate the fruit into the various grades, and it is left to the packers to select the tomatoes of the proper size for the particular pack they are making.

Machine sizing of tomatoes undoubtedly insures more uniform sizing of tomato packs than sizing by hand. However, since there are usually only four different sizes separated by the machines, the packers must pack more than one size of tomatoes from some of these separations. Unless he selects the proper size for the pack he is making, the pack still might not be considered fairly uniformly sized. Irregular sizing from many sections is a constant complaint of receivers in the markets. In most instances they are willing to pay a premium for uniformly sized fruit.

Packing

Packing the lug

The lug-box pack now used generally throughout those areas that ship wrapped mature-green tomatoes is prepared in central packinghouses under the supervision of the shipper. Experienced packers are usually employed for this work, as they must turn out considerable volume in order to make the use of this kind of package profitable.

The packer works at a slightly inclined bench directly adjacent to the bins in which the sorted tomatoes are placed (fig. 14) or next to the conveyor belts in houses where bins are no longer used. He faces in the direction of the bench upon which the empty lug is resting at a convenient height. The paper holder is either attached or placed within convenient reach at the side of the lug box. A rubber finger

cot is often worn by the packer on the thumb or forefinger to facilitate removal of the paper. The packer picks up a wrap from the holder and at the same time selects a tomato from the bin. The tomato is tossed into the palm of the right hand, which is holding the wrapper. This jerks up the edges of the wrapper, and the left hand is quickly brought forward to fold the loose edges of the wrapper around the tomato or to hold it while the tomato is given a half twist. The wrapped tomato is then placed in its proper position in the lug, with folded or twisted portion underneath to act as a cushion, while the left hand reaches for another tomato. If the packer is left-handed he will face in the opposite direction and the movements of right and left hands will, of course, be reversed. The experienced packer will pack tomatoes about as fast as he can pick them out of the bin.



AMS 7701

FIGURE 13.—Bad "catfaces" and tomatoes affected with nailhead spot (*Alternaria tomato*) should be excluded even from the second grade.



AMS 15702

FIGURE 14.—Packers in this Texas packinghouse pack the lugs with tomatoes selected from adjacent bins, after which they place the lugs on the roller conveyor leading to the lidding press.

In packing a lug to secure the proper bulge, skilled packers usually select slightly larger tomatoes for the center of the lug than for the ends. Some tilting of the fruits is also practiced as necessary. As a result of these practices the tomatoes in the center of the lug are usually more tightly packed than those in the ends.

The general shape of the tomatoes and the size determine to a large extent the manner in which the packer will arrange the tomatoes in the lugs. Obviously, distinctly globe-shaped tomatoes must be arranged differently than those that are generally flat-shaped. In general, tomatoes of the larger sizes are packed flat in all three layers. It is usually necessary to pack medium- and small-sized tomatoes on edge in one or more layers to obtain the proper height of the pack. Often the two lower layers of tomatoes are packed on edge and the top layer flat with blossom end up. Certain other sizes will be packed with the tomatoes on edge in all layers. Each individual packer usually develops his own technique for arranging different sizes and shapes of tomatoes in the lugs. From all outward appearances the similar-sized packs of tomatoes put up by different packers may be the same but close examination may show that the position of individual tomatoes with respect to packing flat, tilting, or packing on edge varies considerably.

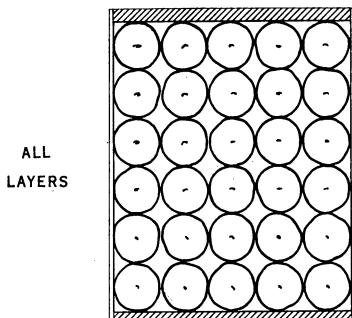
Whenever the packer finishes packing a lug he places a numbered pasteboard or ticket on the lug, which is then removed to the lidding bench or to the conveyor leading to that point. These tickets are collected by the lidder and sent to the office for recording the packer's daily output.

Aside from these general practices employed in packing lugs, tomato packers in the various sections have developed three distinct methods of arranging the tomatoes in the different layers. The common pre-

tice in all sections where the lug is used is to place the tomatoes so that one tomato will be directly above another in the various layers. This is known as the square arrangement and is illustrated in figure 15.

Some shippers, particularly in California, use a method known as the offset arrangement for some sizes of fruit. In this method (fig. 16) alternating space is left at the end of each row in each layer, and theoretically the weight of each tomato in one layer is supported by two tomatoes in the next lower layer.

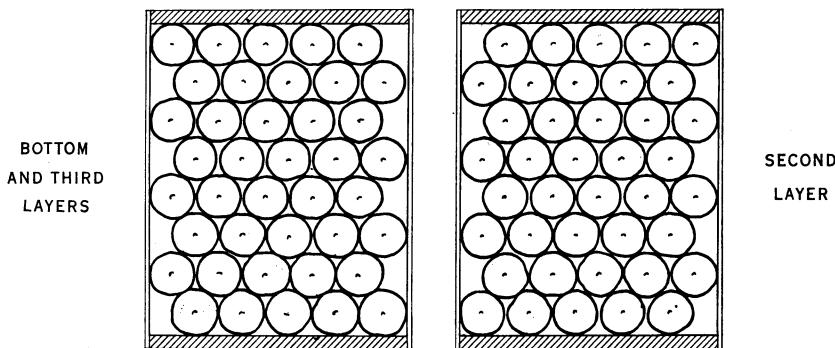
SQUARE ARRANGEMENT



AMS 15823

FIGURE 15.—Diagram illustrating the square arrangement for packing tomatoes in lugs, which is the method commonly used in all producing sections. In this arrangement one tomato is placed directly above another in the various layers, thus making the relative position of the tomatoes the same in all layers. The size of tomatoes as shown in this diagram is designated as 5 x 6.

OFFSET ARRANGEMENT

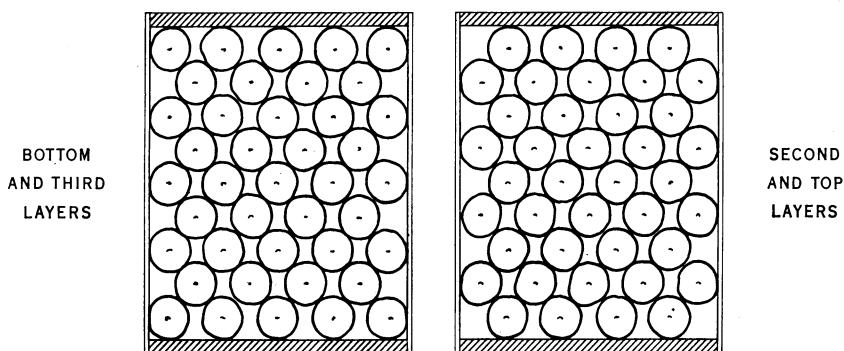


AMS 15822

FIGURE 16.—Diagram illustrating the offset arrangement for packing tomatoes in lugs used by some shippers. Alternating space is left at the end of each row in each layer so that the weight of each tomato in one layer is supported by two tomatoes in the next lower layer. If this arrangement is used for small tomatoes a fourth layer is included, and the position of the tomatoes will be the same as in the second layer shown in the diagram. The size of tomatoes arranged in the top layer as shown in the diagram is designated as 5 x 8. Sometimes it is designated as 5-5 x 8.

In the third method of arrangement, termed "diagonal," a certain amount of space is left between each tomato in each layer. This method is illustrated in figure 17 and is used by some California shippers for packing small-sized tomatoes. Four layers of fruit are packed in the lug where this method is employed. Two layers will have one more tomato than the other two layers, depending on the manner in which the packer starts the pack. As shown in figure 17, there are 5 rows of 5 and 4 rows of 4 tomatoes extending crosswise of the lug, making a total of 41 tomatoes in the bottom and third layers. In the second and top layers there are 5 rows of 4 tomatoes and 4 rows of 5 tomatoes, or a total of 40 tomatoes in these layers. The diagonal pack is more difficult to pack properly than either the square or offset pack.

DIAGONAL ARRANGEMENT



AMS 15821

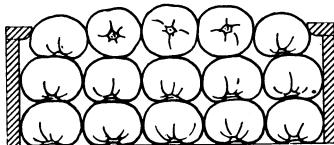
FIGURE 17.—Diagram illustrating the diagonal arrangement in layers for packing tomatoes in lugs used to some extent for small tomatoes by some shippers. A certain amount of space is left between each tomato in each layer, and four layers are packed in the lug to build the pack to the proper height and obtain the required net weight. Note that the bottom and third layers contain one more tomato than the second and top layers. The size of tomatoes arranged as shown in this diagram is designated as 4-5 x 9.

Five styles of lug packs are recognized in the United States standards for fresh tomatoes. They are straight pack, extra-row pack, bridge pack, double-wrap pack, and double-wrap bridge pack. In all of these styles of packs the tomatoes must be at least fairly uniformly sized, and the net weight in the lugs shall be not less than 30 pounds in order to be considered as United States standard packs.

A straight pack is packed with the same number of rows of tomatoes each way of the lug in each layer, except in the case of the U. S. straight square-offset and straight square-diagonal packs. Receivers in the markets generally favor the straight pack over all other styles of packs, and it is becoming increasingly more popular each year. This style usually insures greater uniformity in size of the tomatoes throughout the lug. Some of the most common U. S. straight packs and the method of arranging the tomatoes in the lugs are shown in figure 18. In these diagrams wide cleats are used on the lugs. Many shippers use narrow cleats of the same width as the end pieces of the lug, thus insuring greater uniformity of size in all layers.

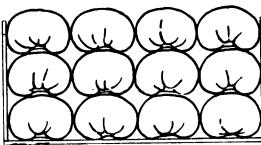
Variations of the straight pack are used by some shippers in California who prefer to pack a square arrangement instead of an offset arrangement for certain sizes. They feel that a square arrangement with the same number of tomatoes each way of the lug is not suited to an oblong container such as a tomato lug, and that less bruising will result from an offset arrangement. However, the offset arrangement does not present an attractive appearance and for that reason a square arrangement is ordinarily used for the top layer. The 1953 revision of the U. S. standards for fresh tomatoes has recognized this situation and the standard pack requirements now provide for certifying a U. S. straight square-offset pack. Occasionally a diagonal arrangement in the lower layers is faced off with a square arrangement in the top layer. Such a pack may be certified as U. S. straight square-diagonal pack.

U. S. STRAIGHT PACKS

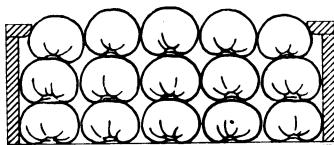


SIDE VIEW

4X5

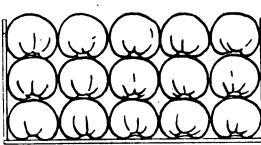


END VIEW

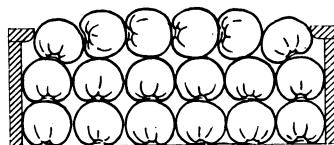


SIDE VIEW

5X5

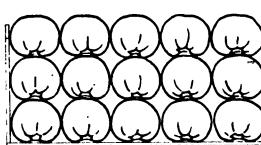


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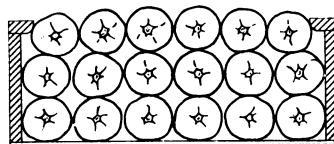


SIDE VIEW

5X6

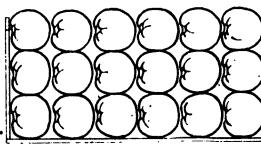


END VIEW



SIDE VIEW

6X6



END VIEW

AMS 15824

FIGURE 18.—Diagram showing the arrangement commonly used by packers for packing various sizes of U. S. straight-style packs. Note that all layers have the same number of tomatoes and that the tomatoes are fairly uniform in size. Receivers generally favor this style of pack.

In the extra-row style of pack the top layer contains one row less of tomatoes one way of the lug than the other layers. Therefore, the tomatoes in the top layer will be somewhat larger than those in the other layers. If the lugs are fitted with wide cleats the variation in size in the layers need not be so great, although the width of the cleats extending over the ends of the lug is not enough to compensate for the full width of a row of tomatoes. The extra-row style of pack is often severely criticized by receivers in the markets because the tomatoes in the top layer, or shown face, are larger than the tomatoes in the other layers. This style of pack is still used extensively, but in many sections is gradually being supplanted by the straight method. Common methods of arrangement employed by packers in packing U. S. extra-row packs with various sizes of tomatoes are illustrated in figure 19.

U. S. EXTRA ROW PACKS

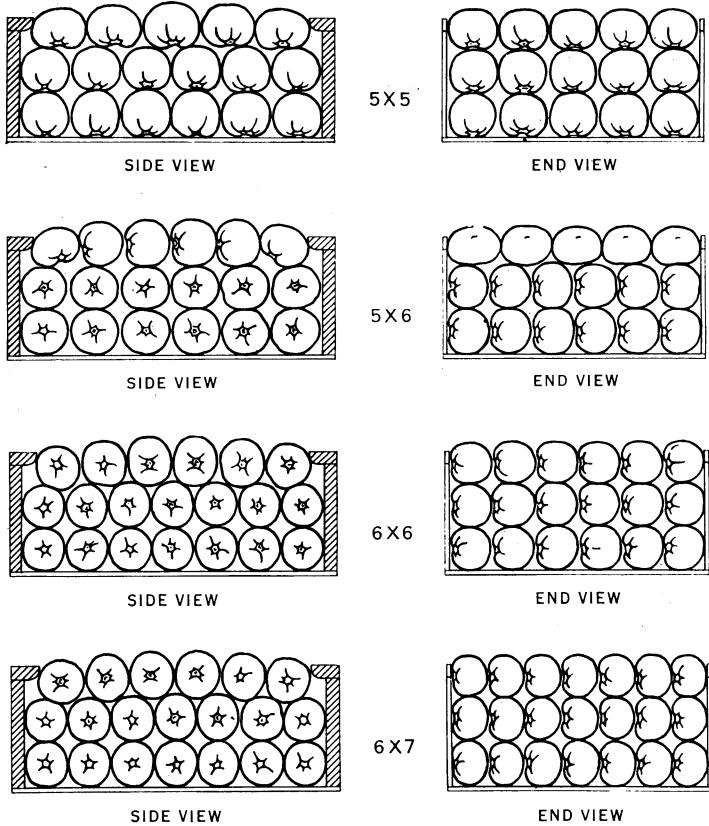
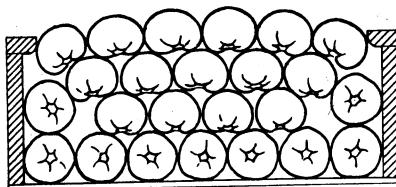


FIGURE 19.—Diagram showing arrangement commonly employed by packers for packing various sizes of U. S. extra-row style packs. Note that the top layer in each pack has one row less of tomatoes one way of the lug than the lower layers and that the tomatoes are generally somewhat larger in the top layer.

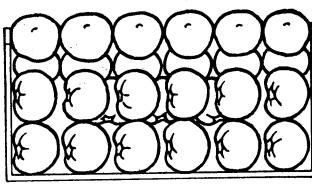
The term "bridge pack" is used to describe the style of pack having three full layers and part of a fourth. It is employed mostly for tomatoes of the smaller sizes, where three layers will not fill the lug to the proper height and insure the required net weight. The bridge is usually made by leaving one or two rows vacant both ways of the lug in the second layer. However, some Texas packers make the bridge by spacing the tomatoes apart. The upper two layers are then packed regularly and the bridge tends to give the proper height and weight to the pack with the bulge in the center. The position of the tomatoes in a typical U. S. bridge pack is illustrated in figure 20.

U. S. BRIDGE PACK



SIDE VIEW

6X6



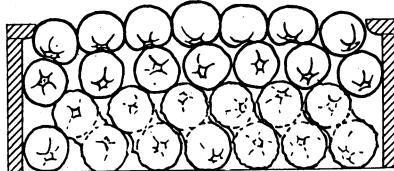
END VIEW

AMS 15820

FIGURE 20.—Diagram showing the position of the tomatoes in a typical U. S. bridge pack. The bridge is used to build the pack to the proper height and obtain the required net weight.

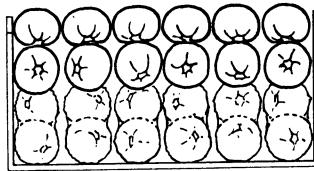
Often small-sized tomatoes are packed with two tomatoes in a wrapper in the bottom layer and sometimes in the middle layer as well. This style of pack is called the double-wrap pack. In starting the pack one row of tomatoes wrapped double is placed flat in the end of the lug nearest the packer. The layer is then completed by wrapping two tomatoes in each wrapper and placing them in the lug at an angle so that one tomato when in position is about half the depth of a tomato higher than the other. This is to insure filling of the lug to the proper height. The tomatoes in the second layer are wrapped either singly or doubly. The tomatoes in the top layer are wrapped in a single wrapper. Figure 21 illustrates the arrangement of the tomatoes in a U. S. double-wrap pack, with the lower layer only having two tomatoes to the wrapper.

U. S. DOUBLE WRAP PACK



SIDE VIEW

6X7



END VIEW

AMS 15826

FIGURE 21.—Diagram showing the position of the tomatoes in a U. S. double-wrap pack commonly used for small-sized tomatoes. The diagram shows only the tomatoes in the bottom layer wrapped double. Often the tomatoes in the middle layer are wrapped double.

The double-wrap bridge pack is a comparatively recent development in packing technique. It is simply a combination of the double-wrap and bridge packs just described. In order to be considered standard, this pack must contain tomatoes that are fairly uniform in size and fairly tightly packed. The tomatoes in the top layer must be packed in separate wrappers and in the lower layer or layers not more than two tomatoes may be packed in a wrapper; furthermore, a part of an additional layer which may have either one or two tomatoes in a wrapper must be packed in the lug.

The size of tomatoes packed in lug boxes is designated commercially by the number of rows of tomatoes running both ways of the lug in the top layer, with the exception of lugs packed with the tomatoes arranged diagonally. For example, the top layer of a lug packed with five rows of tomatoes extending lengthwise and six rows extending crosswise, would be designated as a 5 x 6 pack (fig. 22). The desig-

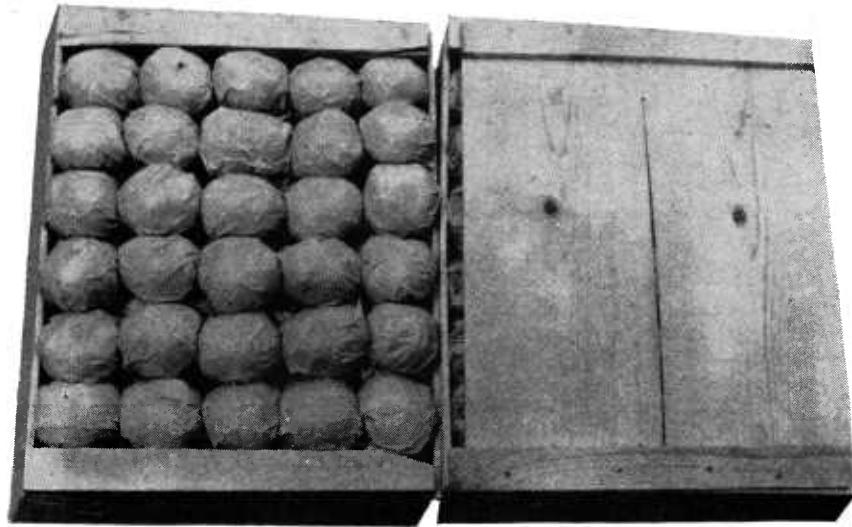


FIGURE 22.—The size in most lug packs is designated by the number of rows of tomatoes running both ways of the lug in the top layer. This represents a well-packed lug box showing medium-sized tomatoes packed 5 x 6.

nation of size, by stating the number of rows of tomatoes both ways of the lug, applies to all styles of packs heretofore described and to all methods of arrangement except the diagonal. Shippers at present are designating size of diagonal packs by using two figures to show the number of tomatoes in the rows crosswise of the lug and a third figure to indicate the total number of crosswise rows in the layer. For example, the size of the tomatoes in the diagonal pack illustrated in figure 17 is designated 4-5 x 9, which means that there are four and five tomatoes in the alternating rows crosswise of the lug with nine such rows in the layer. Other diagonal arrangements commonly packed are 4-4 x 10, 4-5 x 10, and 4-3 x 12. In some instances offset arrangements also are designated in this manner. For example, the arrangement shown in figure 16 would be designated as 5-5 x 8.

The methods now employed for designating size are often misleading and are frequently the cause of disputes between shippers and receivers.

A description of the top layer does not always give a true picture of the size of the tomatoes in the lower layers. The tomatoes in the lower layers of extra-row packs are generally smaller than those in the top layer. The same may be true of bridge and double-wrap packs. The method now employed for describing size of diagonal packs is difficult to understand, and the distant buyer not thoroughly acquainted with the method may find it hard to visualize the size of tomatoes quoted. A better method of describing the size of tomatoes packed in lugs would be to specify the number of tomatoes in the package, provided the tomatoes are fairly uniform in size.

Packing containers for loose-pack tomatoes

The packing of tomatoes in 60-pound wire-bound crates, nailed crates, field crates, 40-pound fiberboard boxes, and other bulk containers is comparatively simple. In most instances houses packing these containers are equipped with mechanical sizing units and the fruit is sized as for packing in lugs. Many packinghouses pack lugs as well as bulk containers, according to the preference of the customer. In filling the crate or other bulk container the tomatoes are poured from the bin or conveyed directly from the sizing unit into the container and the contents leveled off with the top. The fruit is not wrapped and there is no attempt at place packing. The container is usually stamped or otherwise marked to indicate the size arrangement that the tomatoes would pack in a Los Angeles lug. If the fruit were sized to 6 x 6 in a lug, the crate would be marked 6 x 6. Sometimes two sizes are packed in the same container and both sizes marked on the container.

With the trend away from the lug box of wrapped, place-packed tomatoes to the 40-pound or 60-pound container of jumble-packed fruit, without paper wraps, there comes a need for appropriate, descriptive size terms. The designations 5 x 6, 6 x 6 and so on used for tomatoes packed in lug boxes have no meaning when used in connection with bulk containers and are confusing to anyone not familiar with the practice. It is likely that minimum diameters, or minimum and maximum diameters, will find increasing use as a means of designating size of tomatoes in bulk containers.

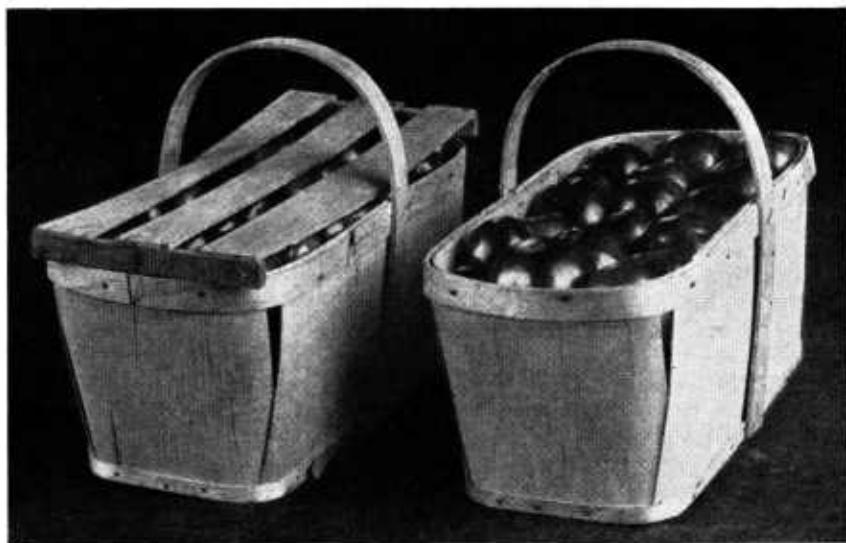
Packing climax, splint, and fiberboard baskets

The packing of tomatoes in climax, splint, and fiberboard baskets is much less complicated than packing tomatoes in lugs. For this reason these types of packages are adapted for use in the East North Central and Middle Atlantic States, where the fruit is mostly packed at the farm in the pink and ripe stages by the producer or members of his family. In Ohio, however, considerable quantities of both greenhouse and field-grown tomatoes are packed in baskets at central packinghouses.

As a general rule, producers of field-grown tomatoes using 12-quart climax baskets do not sort the fruit to uniform sizes and pack them in separate containers. Many producers pack separately the small-sized fruit under 2 or 2 $\frac{1}{4}$ inches in diameter, but the rest is packed together. This often gives a range in size from about 2 inches to over 4 inches in diameter in the same package. Some dealers prefer

to handle fruit more uniformly sized but others would rather have a range of size to satisfy the varied wishes of consumers.

Medium and large tomatoes are generally packed three layers deep in 12-quart climax baskets. If small fruit is packed separately four layers are required to fill the basket. As a rule the tomatoes are not wrapped. They are packed flat or on edge, depending on the size. Often the lower layers are packed on edge and the top layer is packed flat with the blossom end up. In New York, New Jersey, and Pennsylvania most growers aim to pack 20 pounds net to the basket. Some producers simply fill the package and pay no attention to the net weight. Michigan growers usually pack from 15 to 18 pounds net per basket. Packed climax baskets of 12-quart capacity are illustrated in figure 23.



AMS 7836

FIGURE 23.—The 12-quart climax basket is usually packed with three layers of tomatoes.

The 8-quart splint and fiberboard baskets are packed with two layers of fruit. Growers of greenhouse tomatoes generally wrap the better grades of fruit, especially if it is to be transported any great distance. Small-sized tomatoes and fruit of the lower grades are usually not wrapped. Since greenhouse tomatoes are ordinarily picked with stems and calyxes attached, the wrappers offer considerable protection to the fruit from stem punctures.

It is customary for the greenhouse growers to pack separately three different sizes of fruit which they class as small, medium, and large. Tomatoes under 3 ounces in weight are considered small. Those ranging from 3 to about 8 ounces are classed as medium and those over 8 ounces are considered large. The lack of uniformity in size of fruit classed as medium and large is not desirable from the standpoint of some dealers. However, many dealers prefer to have different sizes of tomatoes in a small package to meet the different needs of consumers.

In Ohio, where the 8-quart baskets are now used almost exclusively, producers of field-grown tomatoes pack 10 pounds to the basket, whereas greenhouse growers pack only 8 pounds to the basket. Most of the greenhouse growers and many producers of field-grown fruit place pasteboard dividers between the layers of fruit. It is common practice to lid the packages with closely fitting fiberboard covers, but some growers do not lid packages that are trucked to nearby local markets.

The 16-quart fiberboard baskets, which are becoming increasingly popular for packing field-grown tomatoes in the East North Central States, are ordinarily packed with 20 pounds of tomatoes. They are placed in three layers with pasteboard dividers between each layer.

Packing hampers and round stave baskets

Packing the $\frac{5}{8}$ -bushel hamper and the $\frac{1}{2}$ - and 1-bushel baskets with pink and ripe tomatoes for trucking to nearby markets in the Eastern States is a comparatively simple operation. As a rule all sizes of tomatoes are jumbled in these containers. Some growers, however, often ring-face the top layer with fairly uniform-sized tomatoes, with blossom end up, in order to give the package a more attractive appearance. Ring-facing packages is not to be recommended unless the tomatoes in the shown face are reasonably representative in size and quality of the remainder of the tomatoes in the package.

Care should always be exercised in placing the tomatoes in hampers or baskets to prevent unnecessary bruising of the fruit. Overripe tomatoes should not be allowed in the package as they are likely to be crushed.

Packing the 25- and 50-pound boxes

Repackers in Atlanta, Ga., arrange the tomatoes in 25- and 50-pound boxes in regular rows and layers. The tomatoes so packed are usually fairly uniformly sized and a pasteboard divider is placed between each layer of fruit. The repackers mark the size on the box to correspond with the size of tomatoes in lug boxes as is done with wire-bound crates and other bulk containers.

Packing the western peach box

The western peach box used in some parts of the West for local shipments is ordinarily packed by the growers. Usually two layers of fruit are packed in more or less definite rows in this container.

Marking packages

It is general trade practice to stamp the style of pack in the upper corner of one end of the container when tomatoes are packed in lugs. The size of tomatoes packed in lugs is designated by the arrangement of the tomatoes in the top layer. For example, a lug packed 5 rows wide and 6 rows long in the top layer is stamped 5 x 6. In some packing houses the grower's initials or his lot number are also marked on the package.

During recent years many States have enacted laws requiring certain other markings to be shown on packages. In general, these laws require such markings as the name of the variety, the place where grown, the name of the grower or his lot number, the grade, and the net weight or numerical count. Shippers should consult the laws of their State to make sure of the markings required to be shown on tomato packages.

Under the provisions of the Federal Food, Drug, and Cosmetic Act a food shall be deemed to be misbranded if in package form unless it bears a label containing (1) the name and place of business of the packer or distributor and (2) an accurate statement of the quantity of the contents in terms of weight, measure, or numerical count. Therefore, it is general practice to show the name and address of the shipper or packer on all packages of tomatoes which enter into interstate commerce. Lugs and crates are also marked to show the contents in terms of net weight; and baskets, in terms of dry measure.

Most tomato shippers who pack lug boxes use lithographed or printed labels to identify their particular brands. These should be attached neatly to the containers, as careless labeling always gives the impression that the pack is also poor. Generally, labels are pasted on before the empty containers are furnished to the packers, but some shippers do the labeling in the car as each stack is stowed.

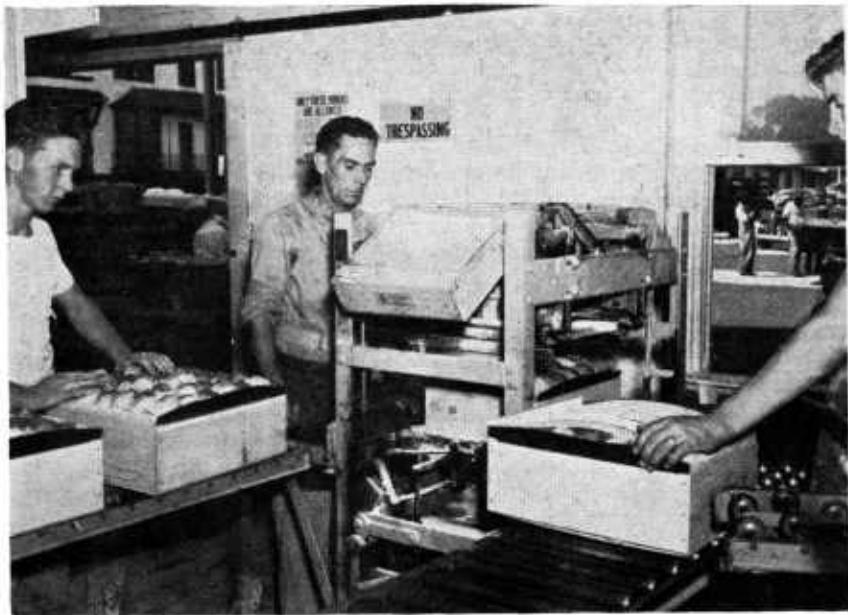
Lidding

In most of the central packinghouses where lugs or other packages requiring nailing are packed, the lidding is done by hand with the aid of a lidding press. The lidding press also serves as a lidding bench. It consists of a framework equipped with press arms which are operated by means of a foot lever. The operator places a packed lug in the press, places the lid in position over the fruit, and applies enough pressure on the foot lever for the press arms to force down the ends of the lid flush with the end pieces on the lug. He then drives the nails and releases the foot lever to allow the press arms to spring back to their normal position.

If a lidding press is not provided, a substantially constructed lidding bench of convenient height should be furnished the nailer.

Lidding presses or lidding benches are usually placed in the rear of the packers' aisle parallel to the packing bins. If the packers place the packed lugs on a roller conveyor leading to the lidding press or lidding bench, it is most convenient to have the top of the rollers even or slightly above the top of the bench so that lugs will slide easily into position for nailing. The lids should be within easy reach of the nailer from a rack overhead or in a stack to one side. If a lidding press is not provided, the lidder nails first one end and then the other, the pressing being done by hand. It is sometimes necessary to settle the fruit packed in a lug with a high bulge by a jar or by a shaking movement before completing the nailing.

Some of the larger packinghouses that handle a large volume of fruit are now equipped with electrically operated lidding machines, such as is illustrated in figure 24. The operator in charge simply fits the lid in place over the fruit and presses a button with his foot and the machine does the nailing. Such labor-saving devices installed in packinghouses where considerable volume is handled tend to cut down overhead costs.



AMS 15707

FIGURE 24.—Electrically powered lidding machines are often used in packing-houses where a large volume of tomatoes is packed.

Loading the car or truck

Fresh tomatoes transported to market by rail are usually loaded in refrigerator cars. When loading a car the packages should be so arranged and the load so braced that it will not shift in transit, and the packages should be placed so as to permit free circulation of air.

Lug boxes, which comprise the bulk of the shipments by rail, are mostly loaded in accordance with the provisions of the freight loading and container tariffs. These tariffs specify that the loading be cross-wise, that double crosswise horizontal car strips be placed on all layers, that the strips on each layer alternately abut the side walls of the car, and that all strips be nailed to each lug in the layer. Thus, the usual loading is 5 rows wide and 5 or 6 layers high with 24 to 26 stacks, depending on the length of the car. Five-layer loads usually have from 600 to 660 packages to the car, whereas 6-layer loads may have 720 to 780 packages.

It is usually necessary to brace the load in the center between the doorways of the car for, as a rule, the stacks will not just fill the lengthwise space. Sometimes excess space is taken up by the use of end bulkheads in one or both ends of the car. Stripping of each layer in each stack is also necessary to insure holding the load intact.

The load is started in the car by placing five lug boxes tightly against the bunker wall in one end, leaving equal spaces between the lugs and also between the lugs and the outside walls. When the layer is in place it is ready for stripping. The car strips should be made of good-quality lumber, preferably 1 inch but not less than $\frac{1}{2}$ inch thick, 1 inch wide, and about 8 feet long. Two strips are placed across the

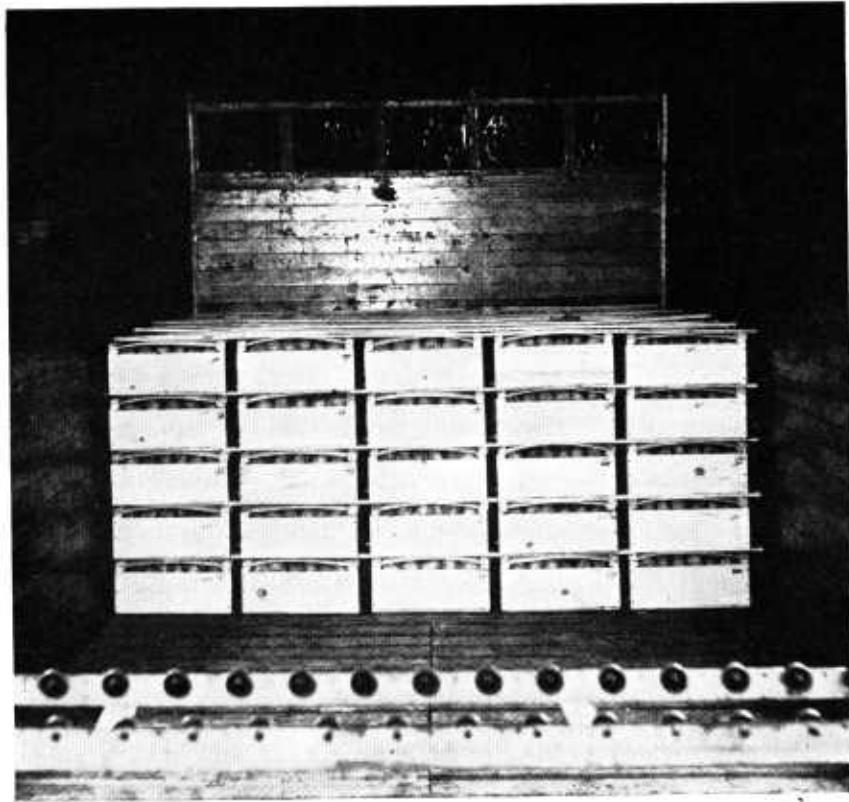
layer about 1 inch from the edge of the lugs, with the end of one strip butting against one wall and the end of the other strip butting against the opposite wall (fig. 25).

The principal purpose of this arrangement is to brace the load from both sides and keep the rows evenly alined. The strips should be nailed with one nail in each package.

The stack is completed by placing additional lugs directly above those already in place and stripping each layer in the same manner as the first. The other stacks are then stowed by placing each lug box directly in front of those in the first stack.

As each stack is stowed, it is advisable to place a board in front of each tier of lugs and tap it lightly in various places with a small sledge hammer. This will assist materially in maintaining a tight load. The opposite end of the car is loaded in a similar manner. If the lugs do not entirely fill the lengthwise space in the car the load must be center braced.

Many shippers use a standard type of center bracing consisting of two gates which fit against each face of the load. Each gate consists of 5 uprights held together by 2 crossbars. The uprights are made of 2- by 4-inch lumber, 2 of which reach to the ceiling of the car.



AMS 7763

FIGURE 25.—Lug boxes are generally loaded in refrigerator cars 5 rows wide and 5 or 6 layers high. Each layer of lugs is double stripped, with the end of one strip butting against one wall and the end of the other butting against the opposite wall.

As many cross pieces of 1- by 4-inch material as there are layers of packages are nailed across the uprights so as to be against the middle of the lugs in each layer. Three spreaders 2 inches by 4 inches, cut slightly longer than the space between the uprights, are wedged and nailed between the uprights on each gate to lock the bracing.

It should be emphasized that the proper nailing, stripping, and bracing of loads is very important if broken packages and those in bad order are to be held to a minimum. Recent studies have shown that cars properly nailed and stripped arrived in the markets with much less damage to packages than those with improper nailing and stripping.⁴

Another type of loading lug boxes which is used by some shippers, particularly in California, is the Hoak method. This method of loading is patented, and any shipper using it must pay a fee for the privilege. As in the conventional method of loading, lugs are loaded crosswise of the car but instead of horizontal stripping being used, vertical spacing strips or units are placed upright between the stacks and rows of containers to hold them in place. Each spacing unit consists of three wooden strips. One strip $\frac{1}{8}$ of an inch thick and from $3\frac{1}{2}$ to 4 inches wide is placed flush between two other strips of the same length that are about $1\frac{1}{4}$ inches thick and $1\frac{1}{2}$ inches wide. These strips are nailed together in such a way that when the units are placed vertically at the point where the corners of the containers in all layers of 2 adjacent stacks and 2 adjacent rows approach each other, the containers in each stack and each row are held firmly in place. By this method each container is held tightly in row and stack alignment, and crosswise and lengthwise slack and load shifting during transit are kept to a minimum.

Another more recent type of loading is the Ellis inverted "V" method, also patented and used for a limited number of California shipments. In this type of loading the lugs are loaded crosswise of the car and no horizontal stripping is used. The load is held in place by wooden frames fashioned into inverted V's and placed in an upright position between the outside rows of containers and the side walls of the car and usually on each side of the center row of containers. The spacing frames are made from 2- by 3-inch or 2- by 4-inch lumber and are held together at the apex by a nail or metal fastener.

Wire-bound crates are usually loaded in cars lengthwise, 19 stacks long, 7 rows wide, 2 to 4 layers high. The usual load is 399 crates. Nailed crates are loaded crosswise of the car, 30 stacks long, 4 rows wide, and 3 layers high. The usual load is 360.

No regular loads have been adopted for trucks. The trucks are usually loaded to weight capacity in any manner that will handle the space most efficiently without damage to the product. Trucks are generally loaded higher than cars, whether lugs, crates, or other containers are used. Figure 26 shows the usual method of loading fiberboard boxes in trucks for long-distance shipment.

Tomatoes packed in climax baskets and other small containers are usually shipped by truck. However, tomatoes packed in climax baskets are occasionally shipped by rail, in which case the load may vary from 700 to 1,000 baskets, depending on the method of stowing.

⁴ See Reduction of Loss and Damage in Rail Transportation of Fresh Fruits and Vegetables by Improved Loading Methods. BAE, USDA. August 1946. [Processed.]

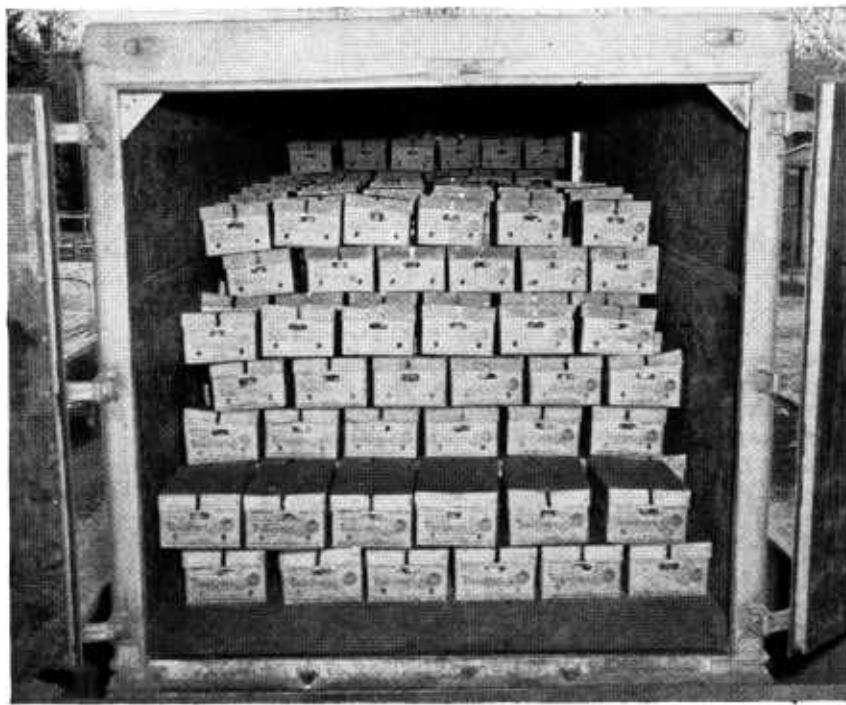
The load generally extends through the full length of the car and is 11 rows wide and 4 or 5 layers high. Sometimes a car is loaded with only 1 layer between the doorways, the load sloping to 5 layers at the end.

Eight-quart baskets of tomatoes when shipped by rail are usually loaded full length of the car crosswise and lengthwise, 6 and 12 rows wide, respectively, and with a varying number of layers. Depending on the number of layers, loads may vary from 1,200 to 2,600 packages per car.

Grades and inspection

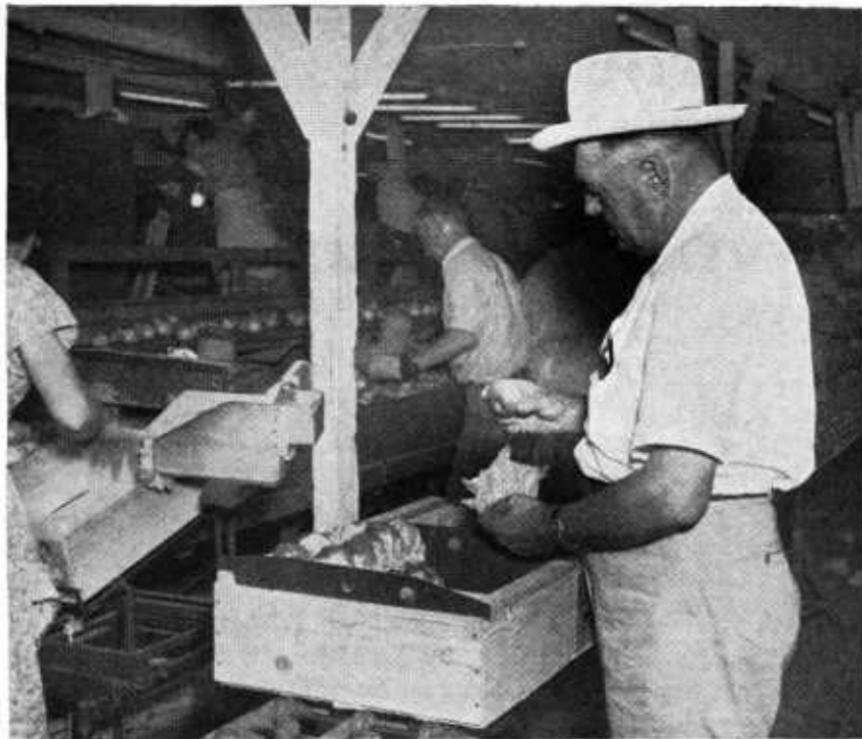
Wholesale trading in fresh tomatoes is largely conducted on the basis of the United States standards. Standards for field-grown tomatoes were first issued in 1922, and in 1933 standards for greenhouse tomatoes were established. The standards define in detail the requirements of the various grades and packs and prescribe the markings that should be shown on the packages. Copies of these standards are available for distribution by the Agricultural Marketing Service, United States Department of Agriculture.

The Federal-State inspection service at shipping point is available in practically all of the important commercial tomato-producing areas. Licensed Federal-State inspectors will inspect a shipment for



AMS 20214

FIGURE 26.—Fiberboard boxes loaded lengthwise in truck, 6 rows wide, 7 and 8 layers high. Boxes are offset to take up excess space and reduce sidewise movement in transit.



AMS 15708

FIGURE 27.—Licensed inspector examining the tomatoes in a packed lug. A large percentage of the carlot shipments of tomatoes are inspected at shipping points by licensed Federal-State inspectors, who issue certificates showing the grade, quality, and condition of the tomatoes in the cars.

an established FCC and issue a certificate showing the quality, condition, grade, and size of the fruit, together with other facts, such as the type of pack, kind of containers used, and method of loading (fig. 27). Federal inspection is also available in the larger markets and the territory adjacent to them.

A total of 31,873 carloads of tomatoes (including truckloads reduced to carlot equivalents) was inspected at shipping points during the fiscal year 1953. This figure includes about 7,600 cars of Mexican tomatoes inspected at the border in Arizona.

The general use of standards by growers and shippers has many advantages. As a basis for trading, their use tends to establish confidence among buyers and sellers, which helps to widen the market. The standards serve as a common language between the shipper and the distant buyer and provide a basis of quoting sales which is generally understood throughout the industry. Inspection at shipping point under established standards tends to prevent unjustified rejections at destination in the case of sales made f. o. b., usual terms. Better production methods among growers are encouraged by the use of standards, as produce of the higher grades usually sells for a premium in price over that of the lower grades or field-run fruit. The presence of large quantities of poor-quality and ungraded tomatoes on the markets adversely affects the sale of good-quality stock.

PREVENT FARM FIRES



Fires kill more than 3,000 farm people each year, and cause painful injury to many thousands more.

In farm homes fire is the main cause of death and injury among younger people.

Each year fires destroy \$133,000,000 worth of farm property.

Much of this loss and suffering can be avoided by taking precautions to prevent fires or by being prepared to control those that do get started. In making a fire-safety check on your own farm, keep in mind that the primary causes of farm fires are—

- Lightning
- Sparks on the roof
- Defective chimneys or heating systems
- Faulty electric wiring or appliances
- Careless smokers
- Careless use or storage of gasoline, kerosene, oily rags, and such
- Children playing with matches

Don't start any fire unless you know you can stop it.

Keep a fire extinguisher handy and make sure every member of the family knows how to use it.

For details, see U. S. Department of Agriculture Farmers' Bulletin No. 1643, Fire Safeguards for the Farm.